ROSS

The Correlation of the Edgewood and Sexton Creek Formations of the Alexandrian Series in Missouri, Illinois, Iowa and Eastern Wisconsin

Geology

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THE CORRELATION OF THE EDGEWOOD AND SEXTON CREEK FORMATIONS OF THE ALEXANDRIAN SERIES IN MISSOURI, ILLINOIS, IOWA AND EASTERN WISCONSIN

BY

CLARENCE SAMUEL ROSS
A. B. University of Illinois, 1913.

THESIS

Submitted in Partial Fulfillment of the Requirements for the

Degree of

MASTER OF ARTS

IN GEOLOGY

IN

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

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JUNE 3 1915

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Clarence Samuel Ross

ENTITLED THE CORRELATION OF THE EDGEWOOD AND SEXTON CREEK FORMATIONS OF THE ALEXANDRIAN SERIES IN MISSOURI, ILLINOIS, IOWA AND EASTERN WISCONSIN

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS.

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on
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INTRODUCTION

The Alexandrian series comprise that portion of the Silurian system lying between the top of the Ordovician and the base of the Niagaran, being composed of three formations in the Mississippi Valley; the Girardeau, the Edgewood, and the Sexton Creek.

During the past three years a study of the Sexton Creek, and Edgewood formations of the Alexandrian series has been carried on by the writer. The first two summers the work was done in company with Dr. T. E. Savage, and while during the past summer Dr. Savage was in the field but a few days the work was done under his direction.

The writer desires to acknowledge his great indebtedness to Dr. Savage for the opportunity to carry out this study, and for the constant help and advice that he has given. The papers of Prof. Charles Schuchert[1] have furnished valuable data for correlation, and the writer has also drawn from the work of Prof. T. C. Chamberlin[2].

The greater part of the Silurian rocks of the southern part of Illinois and all those in the northeastern part of the state of Illinois, and of eastern Wisconsin have long been considered to be of Niagaran age. The present study was begun in

(1)Charles Schuchert: Bull. Geol. Soc. of Am. vol. 25, 1914, pp. 277-320

(2)T. C. Chamberlin: Geol of Wis. vol. II, 1873-1877, pp. 327-389

order to determine what part of the Silurian System could be correlated with the earlier Alexandrian series.

The greater part of the rocks of Sexton Creek age in Illinois are undolomitized and are quite dissimilar to the Niagaran dolomites, from which the lithology of the Edgewood limestone is also usually quite distinct. In eastern Wisconsin there is a very close resemblance between the Niagaran rocks and the underlying earlier Alexandrian limestones. In all of the Illinois region there is a well defined unconformity between the Alexandrian and Niagaran series, but in eastern Wisconsin no unconformity seems to be present at this horizon. The thickness of the limestone of the Alexandrian series of eastern Wisconsin is also much greater than the thickness of the corresponding series in Illinois. Because of these differences, and the evidences that two well defined regions of deposition are represented, it seems best to discuss the two regions separately,after which the necessary correlations between them will be made.

EARLIER STUDIES AND INTERPRETATION OF STRATA.

The name Alexandrian series was proposed by Dr. T. E. Savage[3] in 1908 for that part of the Silurian column between the top of the Ordovician and the base of the Brassfield. In 1909 Dr.Savage[4] included the Brassfield limestone and the Illinois

(3) T.E. Savage: Am. Jour. Sci. vol.xxv, 1908, p, 434.

(4) T. E. Savage: Am. Jour. Sci. vol. xxviii, Dec. 1909, pp. 509-519.

formation of the same general age called the Sexton Creek, in the Alexandrian series.

In 1857 Billings[5] proposed to place all of the strata of the Anticosti section, above what is now defined as the Charleton formation in the Anticosti group. It has since been shown[6] that this portion of the Anticosti section includes strata as low as the Richmond (Late Ordovician), and others as high as the Niagaran series. Billings therefore included too much in his Anticosti group, making it embrace rocks belonging to two distinct systems. For this reason the new name Alexandrian was proposed to provide a place for those strata younger than the Richmond, and older than the earliest of the Niagaran formations of the New York section.

In 1855 Mr. G. C. Swallow[7], who was then state geologist of Missouri, referred the rocks now known as the Edgewood in the vicinity of Louisiana Missouri, to the Onondaga of the Devonian. In the same report Shumard described the limestones in the vicinity of Cape Girardeau, Missouri under the name Cape Girardeau limestone, and considered them the oldest Silurian rocks of the state.

In 1866 Worthen[9] recognized the Girardeau limestone in the vicinity of Thebes, Illinois, but referred it to the Cincinn-

(5) E. Billings: Geol. Surv. of Canada, Report of Progress, 1857, p. 247.

(6) Charles Schuchert: Bull. Geol. Soc. of Am. vol.20, 1909, pp. 427-606.

(7) G. C. Swallow: Geol Surv. of Missouri, Reports 1 and 2, 1855, p. 107.

ati group of the Ordovician. In this report Worthen correlated the gray limestone in the lower part of the bluffs of the Mississippi River in Pike and Calhoun counties, Illinois with the Niagaran of the northern part of the state.

On another page Worthen referred as follows to the rocks in the vicinity of Thebes. "It would appear probable that no beds of undoubted Niagaran age were ever laid down in southern Illinois, but in their places these siliceous limestones, representing in part the age of the Lower Helderberg limestones, and in part the Oriskany sandstones of the New York series, were deposited resting directly upon the Cincinnati group of the Lower Silurian."

In a report on the geology of Alexander County, Illinois, published in 1868 Worthen[10] again assigned the Girardeau limestone to the Lower Helderberg.

Again in 1870 Worthen[11] restated his belief that the early Silurian strata in southwestern Illinois represented the same geological horizon as the Niagaran dolomites in the central part of the state.

In the same year Worthen[12] considered as equivalent to the Niagaran dolomites, those rocks found in the lower part of

(9) A. H. Worthen: Geol.Surv. of Ill. vol. i, 1866, p. 130

(10) A. H. Worthen: Geol Surv. of Ill. vol. iii, 1868, pp. 20-32.

(11) A. H. Worthen: Proc. Am. Asso. Adv. Sci., vol xix, 1870, p. 172.

(12) A. H. Worthen: Geol Surv. of Ill. , vol iv, 1870, pp. 6,7,and 26.

the Mississippi River bluffs of Pike, and Calhoun counties Illinois, that we now know to be of Edgewood, and Sexton Creek age.

In 1870 Worthen[13] described the geology of Will, and Kankakee counties in the northeastern part of the state of Illinois, but did not distinguish the rocks outcropping along the Des Plaines and Kankakee rivers from the Niagaran.

In 1873 Potter[14] made a report on the geology of Lincoln county, Missouri, and referred the oolite, which is a local phase of the Edgewood limestone, to the Onondaga of the Devonian.

In 1892 Keyes and Rowley[15] correlated the oolite and the overlying buff dolomite with the Niagaran limestone. Again in 1897 Rowley[16] in his report on the geology of Pike county, Missouri, considered the oolite to be of Clinton age, and the overlying buff limestone to be of Niagaran age.

In 1908 Dr. T. E. Savage[17] correlated the gray and mottled red limestones in the vicinity of Thebes, Illinois with the Brassfield of Ohio. The next year[18] he proposed the name Sexton Creek

(13) A. H. Worthen: Geol. Surv. of Illinois, vol. iv, 1870, pp. 6, 7, and 26.

(14) W.B. Potter: Geol. Surv. of Missouri, 1873, p. 242

(15) C. R. Keyes: Am. Jour. Sci. vol. xliv, 1892, p. 447

(16) Keyes and Rowley: Proc. Iowa. Acad. Sci. vol, iv, 1897, , pp. 26-40.

(17) T. E. Savage: Am. Jour. Sci., xxv, May, 1908, pp.431

(18) T. E. Savage: Am. Jour. Sci. Vol. xxvii, 1909 pp. 509-519.

for these rocks of Brassfield age, and the name Edgewood limestone for that part of the Alexandrian series lying between the Girardeau and Sexton Creek limestones.

In 1910[19] the Channahon limestone was regarded as equivalent to some part of the Edgewood formation, and the year following the Essex was provisionly referred to a position above the Edgewood by Dr. Savage.

In 1914 Keyes again[20] correlated the Edgewood limestone found in the vicinity of Louisiana, Missouri, with the upper part of the Silurian section of Iowa.

In the same year Savage[21] made a further report on the Alexandrian series, correlating the strata occurring along the Des Plaines River with the Sexton Creek formation of the southern part of the state , and definitely correlating the Essex and Channahon limestones with the Edgewood formation. The undolomitized Silurian limestone of Fayette county, Iowa, was also correlated with the Sexton Creek, and the buff dolomite in the lower part of the Silurian section of northeastern Illinois was correlated with the Edgewood.

(19) T. E. Savage: Ill. State Geol. Surv. Bull. No. 16. pp. 302-341.

(20) Charles Keyes: Am. Jour. Sci. vol. xxxvii, 1914 pp. 254-256.

(21) T. E. Savage: Am. Jour. Sci. vol.xxxviii, May, 1914, pp. 28-37.

In eastern Wisconsin very little work was done upon the lower part of the Silurian section until the report of T. C. Chamberlin[22] in 1877. The iron ore at the base of the Silurian section early attracted attention, and different authors referred the limestone occuring immediatly above the so-called Clinton iron ore to the Niagaran.

In 1852 Whittlesey[23] made a report on the Iron Ridge ores in which he referred the limestone overlying the iron ore to the Clinton group, and briefly described the Silurian escarpment of Wisconsin.

In 1862 Hall[24] discussed the limestones in the lower part of the Silurian section of Wisconsin, and correlated them with the Clinton stage of the New York section.

Since the summer of 1912 Prof. Charles Schuchert[25] has been making a study of the early Silurian strata in Ontario and New York, that are nearly equivalent to the upper part of the Alexandrian series. This work has now progressed so far that a provisional correlation can be made between parts of the Alexandrian and the Medina and Cataract formations of the eastern regions. Hall was the first to propose Medina as a formation

(22) T. C. Chamberlin: Geol. Surv. of Wis. 1873-1877 pp. 327-371

(23) Charles Whittlesey: Rept. of Geol. Surv of Wis. Ia. and Minn., 1852, pp. 418.

(24) James Hall: Rept. Geol. Surv. of Wis., vol. I pp. 57-69

(25) Charles Schuchert: Bull. Geol. Soc. of Am. vol. 25, Sept. 1914, pp. 377-320.

name,but Vanuxem in 1840 was the first to use the name in print.

In 1909 Twenhofel began a study of the classic section exposed on the Island of Anticosti, in the Gulf of St. Lawrence, and in 1914[26] he made a report on the faunas of the Anticosti Island that make possible correlations with the rocks of that region.

(26) W. H. Twenhofel: Mus. Bull. No. 3, Canada Dept. Mines, Oct. 1914.

GENERAL STRATIGRAPHIC RELATIONS.

The lowest member of the Alexandrian series is the Girardeau limestone which is followed above by the Edgewood formation, and that in turn by the Brassfield or Sexton Creek limestone, which is the highest member of the series. The Alexandrian series thus includes all of the rocks of the Silurian system between the top of the Ordovician system, and the top of the Brassfield or Sexton Creek limestone.

The Girardeau limestone is confined to a rather small area in the vicinity of Thebes, Illinois, and Cape Girardeau, Missouri, where it is underlain by the Orchard Creek shale (Ordovician), and is overlain by the Edgewood limestone.

The Edgewood limestone has a much wider extension than the Girardeau limestone, resting in places on the Girardeau limestone, and in others on the Maquoketa shale (Ordovician), and is overlain by the Sexton Creek limestone or by later sediments.

The Sexton Creek limestone has a still wider extension than the Edgewood, and is overlain by Niagaran dolomites, or by much later formations.

In northeastern Illinois the Alexandrian strata always rest upon Maquoketa shale, and are followed by Niagaran dolomites.

The early Silurian rocks that have received the name Winston(27) limestone are found in the northeastern part of Illinois,

(27) T. E. Savage; Am. Jour. Sci. vol. xxxviii, July 1914, pp. 28-37.

and the adjoining part of Iowa where they rest upon the Maquoketa shale and are overlain by Niagaran dolomites.

The nondolomitic, gray limestone at the base of the Silurian section in Fayette County, Iowa, is of Sexton Creek age, but occupies the same stratigraphic position above the Maquoketa shale, and below the Niagaran dolomites that the Winston limestone holds farther east.

In eatern Wisconsin the rocks of Alexandrian age overlie the shale or the Iron ore of Maquoketa age, and pass upward into the Niagaran rocks with no apparent depositional hiatus. The exact upper limits of the Alexandrian series are very difficult to determine, for in addition to the absence of any recognizable unconformity, there is an entire absence of fossils through a considerable thickness at about the horizon in which the contact of the Alexandrian and the Niagaran rocks should be found.

THE EDGEWOOD FORMATION IN ILLINOIS AND MISSOURI.

Dr T. E. Savage[28] has done a large amount of work on this member of the Alexandrian series, the name Edgewwod having been

(28) T. E. Savage: Am. Jour. Sci. vol. xxvii, Dec. 1909 pp. 509-519.
Savage: Ill. State Geol. Surv. Bull. 16, 1910, pp. 305-341
Savage: Trans. Ill. Acad. Sci. vol. iv, 1912, pp. 97-103
Savage: Ill. State Geol Surv. Bull. 20.
Savage: Ill. State Geol. Surv. Bull 23.
Savage Am. Jour. Sci. Vol. xxxviii, July, 1914, pp. 28-37.

proposed by him in 1909[29]. For purposes of correlation a synopsis of this formation is made from the publications of Dr. Savage

Occurrence-In the Mississippi valley there are three differant regions in which the Edgewood limestone is exposed, and a fourth where rocks of Edgewood age are found, but in the latter they represent a different province or basin of deposition. The most important area is near the mouth of the Illinois River, and extending north on both sides of the Mississippi River, as far as Hannibal, Missouri. The best exposures are in Pike County, Missouri, where three different phases of the Edgewood have been described. A very good section is found near the village of Edgewood, and other good exposures occur near Louisiana, Missouri, Bowling Green, and Cyrene in this county. There are also good outcrops in both Ralls, and Lincoln counties, Missouri. East of Louisiana, Missouri, the Edgewood limestone outcrops at the base of the bluffs of the Mississippi River in Pike county, Illinois. A number of exposures of these strata occur in Calhoun county, Illinois in the bluffs of both the Mississippi, and Illinois rivers, and other good outcrops are found near the south side of Jersey county, Illinois.

The second area is in the northern part of Alexander county, Illinois, near Thebes. The third area in which the Edgewood limestone is exposed is in northeastern Illinois. Near Oswego, in Kendall County, the Edgewood formation is overlain by the Sexton Creek limestone. Near Essex in Kankakee county is an outcrop of Essex limestone which is known to be a phase of the Edgewood limestone. Along the north bank of the Des Plaines River

near Channahon, in Will county, are several exposures of strata of Edgewood age.

At the south entrance to the tunnel of the Chicago and Great Western railroad, at Winston station in Jo Daviess county, there are strata lying below the Niagaran limestone that are plainly of Edgewood age. These strata are thought to represent a different province of deposition, from those in southern and northeastern Illinois. Rocks corresponding to the Winston limestone, outcrop near Bellevue Iowa.

Detailed Sections.

Near Thebes, in Alexander county, Illinois, there is an excellent exposure of the Edgewood formation, and of the older Girardeau limestone of the Alexandrian series.

Section of strata exposed one and one half miles north of Thebes.

	Feet	Inches
4 to 10 Edgewood formation (Cyrene member)		
10. Heavy, gray, coarsely granular limestone, oolitic in the upper part, with fossils.------	3	6
9. Rather soft, gray shale, without fossils.-----	1	2
8. Dark gray, argillaceous limestone, or calcareous shale, in two layers each about six inches thick, separated by a 2-inch parting of softer shale; the calcareous layer containing fossils.--------------------------	1	3

	Feet	Inches
7. Rather soft, gray shale, without fossils.	1	6
6. Layer of somewhat fissle, fine grained, argillaceous limestone, containing few fossils.	1	6
5. Layer of hard limestone, having a two-inch band of chert at the top, no fossils found.		8
4. Layer of conglomerate, containing fragments of Girardeau limestone, 2 to 12 inches in diameter imbedded in a matrix of fine grained limestone. In some places this member appears to be composed of calcareous concretions surrounded by softer, bluish-gray shale.	2	6
A break in sedimentation.		
3. Girardeau limestone; hard, brittle, fine grained, dark colored limestone, with fossils characteristic of the Girardeau limestone.	2	6
2. Orchard Creek shale (Richmond); Bluish-gray calcareous shale.	18	
1. Thebes sandstone; Brown or chocolate colored, rather fine grained sandstone.	40	

Section of strata in an abandoned quarry, one-fourth mile southwest of Gale.

	Feet	Inches
4. Sexton Creek limestone; Hard, gray limestone, in layers 4 to 8 inches thick, separated by 2- to 3-inch chert bands.	11	

Feet Inches

A break in sedimentation.

3. Edgewood formation (Cyrene member): Single layer of somewhat oolitic limestone, containing small pebbles of chert¼ to 4 inches in diameter.--10

A break in sedimentation.

2. Orchard Creek shale: Bluish-gray shale, bearing 1- to 2-inch bands of impure, concretionary limestone, 4 to 6 inches apart.-----------------8

A break in sedimentation.

1. Thebes sandstone: Brown, fine grained, slightly shaly sandstone.---------------------------------6

Another good exposure of the Edgewood formation occurs near Louisiana, Missouri, where the following section is exposed along the south bank of Noix Creek.

Section of strata exposed along Noix Creek, near Louisiana Missouri. Feet Inches

3. Upper Devonian shale: Dark colored, fissil shale with few fossils.---------------------------------3
2. Edgewood limestone(Noix Oolite): Light gray oolite, in thin layers, containing a great number of fossils.--------------------------------------8
1. Orchard Creek shale: Bluish gray shale, with few or no fossils.-----------------------------------9

Strata equivalent to those of the Edgewood limestone near Thebes, Illinois, are well developed in the vicinity of Edgewood, in Pike county, Missouri. Along the streams one to one and one-half miles east and northeast of this town the following strata are found.

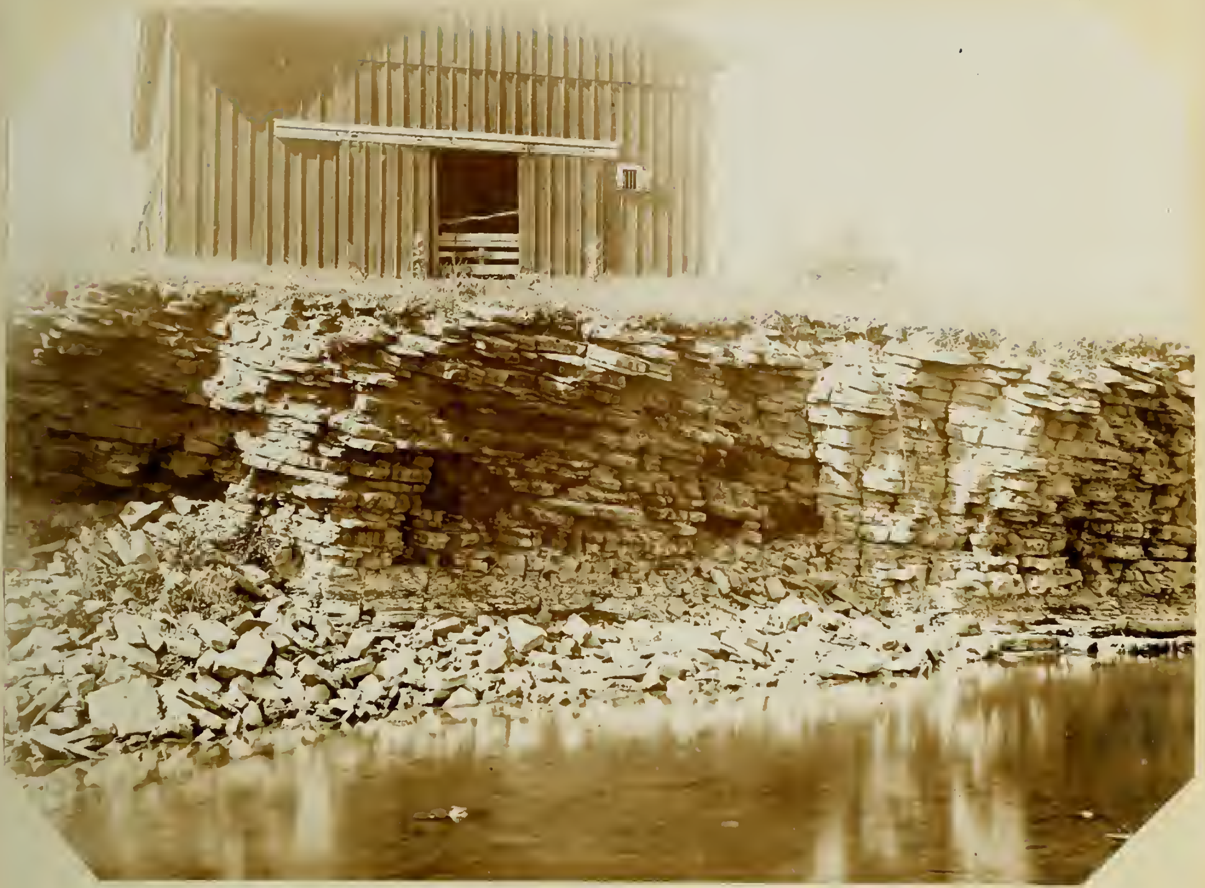
Section of strata exposed one and onehalf miles northeast of Edgewood, Missouri.

	Feet	Inche
Members 2 and 3 are Edgewood limestone.		
3. Brown to yellow limestone, with few or no fossils (Bowling Green limestone member).	22	
2. Brown limestone in layers 2 to 6 inches thick, with many fossils.	6-to 11	
1. Orchard Creek shale: Bluish-gray shale.	9-to 14	

In northeastern Illinois the Channahon member of the Edgewood limestone is exposed along the south bank of the Des Plaines River, about one mile southeast of the village of Channahon, in Will county, as shown in the following section.

Section of Channahon limestone exposed near Channahon Illinois

	Feet	Inches
3. Dark gray to brown, rather fine grained, impure limestone, in layers 3 to 6 inches thick, containing many fossils.	1	6
2. Dark colored limestone, consisting of a fine grained matrix in which are imbedded many simple corals.	2	6
1. Fine grained, yellowish-gray sandstone, without fossils, to the level of the water.	5	



Outcrop of Essex Limestone on Horse Creek, near Essex.

The Essex limestone includes the strata outcropping along Horse Creek, one and onehalf miles east of the town of Essex in Kankakee county Illinois.

Section of Essex limestone near Essex, Illinois.

	Feet	Inches
3. Sexton Creek limestone: Yellowish-brown, much weathered masses of magnesian limestone, containing nodules and masses of chert.------------------------	3	6
Members 1 and 2 are Essex limestone.		
2. Yellowish-brown, thin bedded, magnesian limestone, in layers 3 to 5 inches thick, with numerous fossils.	8	6
1. Rather hard, thin bedded, bluish colored, shaly limestone, in layers 2 to 6 inches thick, exposed above the level of the water.------------------------	2	

Early Silurian strata representing the Edgewood period of deposition occur in Jo Daviess county, in an exposure about six miles southeast of Galena Junction, in the cut at the station of Winston, at the south end of the tunnel made by the Chicago and Great Western railroad.

Section of strata at Winston, Illinois.

	Feet	Inches
3. Dolomite, yellow, earthy, fine grained, in rather thin, even layers.----------------------------	22	
2. Bluish, calcareous, shaly sandstone,-------------	6	
A break in sedimentation.		
1. Maquoketa shale: Bluish-gray shale, without fossils	7	

In the south bank of the Des Plaines River, two miles south of Channahon, and one mile below the exposure of the Channahon limestone already described, strata corresponding to number 2 of the old section of Channahon are exposed above 8 feet of bluish (Maquoketa)shale , together with beds representing a zone 5 to 7 feet higher. One and one-half miles farther down the river a small quarry has been opened in the south bank ,exposing a thickness of about 14 feet of brown limestone, the lower part of which was of the same level as the upper part of that just described, and at a level a few feet higher beds of Sexton Creek limestone are found only a short distance away.

The following table of Edgewood fossils has been compiled from the different reports of Dr. Savage. [29]

---

(29) Savage: Am . Jour. Sci. vol. xxviii, Dec. 1909
pp. 509-519
Savage: Ill. State Geol Surv. Bull. 16. 1910, pp.
302-341.
Savage: Trans. Ill. Acad. Sci. vol. iv, 1912
pp. 97-103.
Savage: Ill. State. Geol.Surv. Bull. No.20
Savage Ill. State Geol. Surv. Bull. No. 23.
Savage: Am. Jour. Sci. vol. xxxviii, July, 1914
pp. 28-37.

Comparative Table of Fossils from the Edgewood Limestone.

Localities: Column 1 near Thebes, Illinois; column 2 near Edgewood, Missouri; column 3 Noix oolite near Louisiana, Missouri; column 4 near Oswego Illinois; column 5 near Channahon Illinois; column6 near Winston Illinois; column7 near Essex, Illinois.

	1	2	3	4	5	6	7
Clathrodictyon vesiculosum Nich.and Murie	x	x	x	x	x		
Calapoecia favositoidea Savage	x	x	x				
Calvina edgewoodensis Savage	x						
Favosites niagar~~a~~ensis Hall							x
Favosites favosusGoldfuss				x			x
Favosites subelongus Savage	x	x	x				
Favosites sp.					x		
Halysites catenulatus Linneaus			x			x	x
Lyellia thebesensis Foerste	x	x	x		x		
Zaphrentis ambigua Savage	x	x	x		x		
Zaphrentis subregularis Savage	x	x	x		x		
Zaphrentis cf. stokesi Edwards and Haime	x	x	x		x		
Zaphrentis sp.				x			
Atrypa praemarginalis Savage	x	x	x	x	x	x	
Atrypa putilla Hall and Clark	x	x	x	x	x	x	x
Atrypa tubulistriata Savage	x	x	x				
Atrypa sp.					x		x
Brachyprion stropheodontoides Savage			x				

	1	2	3	4	5	6	7
Brachyprion latisculptilis Savage		x	x				
Camarotoechia?near acinus Hall							x
Camarotoechia?antiqua Savage	x	x					
Camarotoechia? cliftonensis Foerste							x
Camarotoechia?concinna Savage	x	x	x	x	x	x	
Clorinda thebesensis Savage		x					
Dalmanella edgewoodensis Savage	x	x	x		x	x	x
Dalmanella edgewoodensis var.							x
Gypidula simplex Foerste					x		
Hindella ambigua Savage	x	x					
Homoeospira fiscellostriata Savage			x				
Homoeospira subcircularis Savage		x	x				
Leptaena rhomboidalis Wilckens	x	x	x	x	x		x
Lingula sp.						x	
Lingula illinoisensis Savage					x		
Orbiculoidea sp.						x	
Orthis flabellites var.fissiplicata Foerste			x	x	x		
Pentamerus parvulus Savage			x				
Pholidops channahonensis Savage					x		
Platystrophia daytonensis Foerste	x	x	x				
Plectambonites sp.				x			
Protozeuga sulcocarinata Savage			x				
Rafinesquina mesicosta Shumard	x	x	x				
Rafinesquina mesicosta var. mesistria Savage			x				
Rhipidomella hybrida Sowerby					x		x
Rhipidomella tenuilineata Savage			x				

	1	2	3	4	5	6	7
Rhynchonella? janea Billings	x	x					
Rhynchotreta intermedia Savage					x		
Rhynchotreta parva Savage	x	x	x		x		
Rhynchotreta simplex Foerste							x
Rhynchotreta thebesensis Foerste	x	x	x	x			x
Rhynchotreta thebesensis var. multistriata (Savage	x				x		
Schuchertella curvistriata Savage					x		x
Schuchertella cf. missouriensis Shumard			x				
Schuchertella missouriensis var convexa Savage			x				
Schuchertella propinqua Meek and Worthen	x	x	x				
Schuchertella subplana Conrad							x
Strophonella sp.							x
Whitfieldella acuminata Savage					x		x
Whitfieldella ovoides Savage	x	x	x	x	x		x
Whitfieldella speciosa Savage	x	x	x				
Bellerophon consimilis Savage	x	x					
Bellerophon cf. exiguus Foerste	x	x	x				
Bellerophon sp.							x
Bucunia sp.			x				
Callonema pristina Savage					x		
Cyclonema daytonensis Foerste	x	x	x		x		x
Cornularia sp.							x
cf. Cyclora alta							x
Diaphorostoma niagarensis Hall	x	x	x	x	x		x

	1	2	3	4	5	6	7
Diaphorostoma illinoisensis Savage					x		
Holopea minuta Savage		x					
Hormotoma tenera Savage	x	x	x				x
Hormotoma sp.				x			
Liospira cf. affine Foerste			x				
Lophospira thebesensis Savage		x	x	x			
Pleurotomaria sp.							x
Poleumita bellasculptilis Savage		x		x	x		
Straparollus pumilis Savage		x					
Colpomya abrupta Savage		x	x				
Ctenodonta subelliptica Savage		x		x			
Cypricardinia subquadrata Savage			x				
Modiolopsis sp.							x
Mytilarca mytiliformis Hall							x
Pterinca thebesensis Meek and Worthen	x	x	x				
Pterinea elegans Savage							x
Dawsonoceras tenuilineatum Savage		x		x			
Orthoceras sp.				x			
Cornulites sp.				x			
Calymene sp.				x		x	
Cyphaspis intermedia Weller	x	x	x	x			
Dalmanites sp.					x		
Dalmanites danai Meek and Worthen	x	x					
Encrinurus sp.				x	x	x	
Metapolichas breviceps var. clintonensis (Foerste	x	x	x		x		

	1	2	3	4	5	6	7
Isotelus longaevus Savage	x						
Metapolichas ferrisi Weller					x		
Proetus channahonensis Weller					x		
Proteus determinatus Foerste	x	x	x			x	
Leperditia illinoisensis Savage					x		

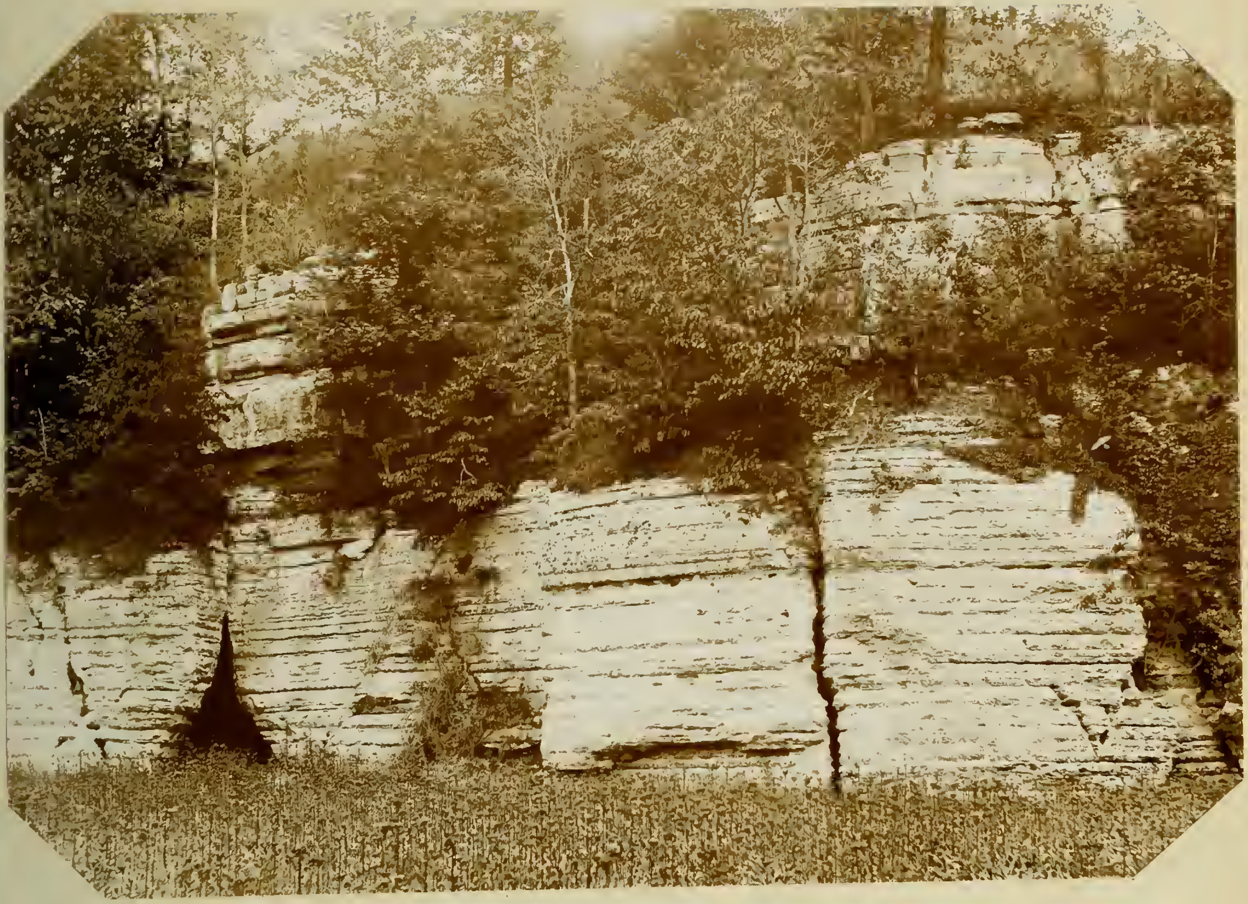
THE SEXTON CREEK LIMESTONE IN THE ILLINOIS-MISSOURI REGION

Distribution of Strata.

The Sexton Creek limestone has the same general distribution as the Edgewood limestone already described, but in all these areas the distribution of the former is more widespread. The Sexton Creek limestone in Illinois and Missouri does not cover large areas, but numerous outcrops occur in four rather widely separated regions. The southernmost area is that of southern Illinois, near Thebes, and in southeastern Missouri near Cape Girardeau. Another area is in the northeastern part of Missouri, in Pike county, and in the adjacent parts of Illinois, in Pike, Calhoun, and Jersey counties, The third area is in the northeastern part of Illinois along the Fox, Kankakee, and Des Plaines rivers, in Will, Kankakee, Kane, and Kendall counties. In the vicinity of Channahon, Illinois, the Sexton Creek limestone outcrops over an area of many square miles, but in all the other regions these strata are overlain by younger rocks, so that they are exposed only along the stream valleys.

Detailed Sections of the Sexton Creek Limestone.

In the northern part of Alexander county, Illinois there are a number of good outcrops of the Sexton Creek limestone, and the following sections have been made in that region.



Sexton Creek Limestone.

Exposure Along the Banks of Sexton Creek, One and One-half Miles North of Gale, Illinois.

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Section of strata exposed one and one-half miles south of Thebes.

3 to 5 Sexton Creek limestone.	Feet	Inches
5. Red or pink, mottled, fine grained, brittle limestone, in layers 8 to 36 inches thick, with a fauna of very small fossils.	8	10
4. Light gray, rather fine grained limestone, with small patches of green shaly material, and many nodules of chert, containing Stricklandinia triplesiana, and Triplecia ortoni.	11	9
3. Chert bands 3 to 4 inches thick, separated by 2 to 3 inches of hard, impure, limestone, without fossils.	5	6
1 and 2 Girardeau limestone.		
2. Dark, fine grained, brittle limestone, breaking with conchoidal fracture.	15	
1. Dark colored, fine grained, brittle limestone, in layers 2 to 4 inches thick, separated by partings of calcareous shale.	18	

Section of strata exposed in the east bank of Sexton Creek one and one-half miles north of Gale.

4 to 10 inclusive are Sexton limestone.	Feet	Inches
10. Pink or mottled red limestone, in layers 14 to 32 inches thick, containing many small fossils.	14	
9. Massive layers of fine grained, pink, limestone, with many small brachiopods and trilobites,	3	6
8. Beds of pink or mottled limestone, very fine grained, in layers 10 to 28 inches thick.	6	
7. Layer of cherty limestone.		6

	Feet	Inches
6. Drab, compact limestone, in layers 2 to 8 inches thick, separated by bands of chert.	2	4
5. Very hard, dark gray limestone, in layers 2 to 4 inches thick,alternating with 2-to 4-inch chert bands.	2	6
4. Ledge of limestone, in layers 3 to 8 inches thick, which are separated by bands of chert, containing but few fossils.	41	
3. (Girardeau limestone): Fine grained limestone.	4	
2. (Orchard Creek shale): Consisting of alternating shale and calcareous bands.	3	6
1. (Thebes sandstone):Fine grained, slightly shaly sandstone.	4	

The upper red or mottled beds in the vicinity of Thebes are unusually interesting. They contain numerous fossils, which for one speciman of Calymene vogdesi, were very small. Fragments of Trilobites with a glabella 1/8 to 3/16 of an inch in diameter are common. Orthoceras sp. with dimensions of 1/16 by 1/2 inch, shells of Atrypa reticularis, Dalmanella elegantula, Plectam bonites transversalis var. elegantula, and Bilobites bilobus not over 1/8 of an inch in diameter were found. Some cause, possibly the same that resulted in the red color of the rocks, has caused this remarkable reduction in the size of the fauna over that of the normal Sexton Creek fossils. There are no new species introduced, tho many forms found in the lower beds of the Sexton Creek limestone have not been found in the higher red beds. There is no sign of a break in sedimentation, and that together with the

similarity of the faunas make it clear that the strata are all of Sexton Creek age notwithstanding the marked differance in color.

Some of the best sections in the western area are found in vicinity of Grafton, Illinois, and this is also the only place where a clear contact of the Sexton Creek limestone with the overlying Niagaran limestone has been found.

Section of strata exposed along Daggetts Creek, which joins the Mississippi River, at the west side of Grafton.

Members 4 and 5 are Sexton Creek limestone.	Feet	Inches
5. Evenly bedded, yellowish-gray limestone, in layers 4 to 8 inches thick.	12	
4. Yellowish brown limestone, with a thick layer at the base, the upper part of which contains Pentamerella? manniensis,	3	
Members 2 and 3 are Edgewood limestone.		
3. Yellowish-brown limestone, with few or no fossils, (Bowling Green member).	20	
2. Oolite, weathered yellow to brown.	3	
A break in sedimentation.		
1. (Maquoketa shale): Yellowish-gray shale.	10	

Section of strata exposed one-half mile above the mouth of Daggetts Creek.

Number 3 is Sexton Creek limestone.		
3. Yellowish-gray limestone, with Pentamerella? manniensis near the top.	1	6
2. (Bowling Green member of the Edgewood limestone):		

Feet Inches

Yellowish-gray limestone, in layers 4 to 9 inches
thick.--10

Section of strata exposed one-fourth mile east of Daggette Creek.

Feet Inches

3.(Niagaran limestone): Massive buff yellow dolomite-15

2. (Sexton Creek limestone): Rather thick bedded,
yellowish-gray limestone, with Pentamerella?
manniensis near the bottom, and Rhinopora verrucosa,
Clorinda, and Triplecia ortoni near the top.--------22

A possible break in sedimentation.

1. (Edgewood limestone): Even bedded, yellowish-gray
limestone in layers 2 to 8 inches thick.------------10

Along a branch two and one-half miles west of Grafton the following section is exposed. Feet Inches

3. (Niagaran limestone); Massive, porous, rough
surfaced dolomite.----------------------------------30

2. (Sexton Creek limestone): Gray limestone in layers 16 to 24 inches thick, containing Pentamerella?
manniensis, near the bottom, and Rhinopora verrucosa
and Triplecia ortoni near the top.-----------------25

1. (Edgewood limestone): Yellowish-gray limestone,
in layers 2 to 9 inches thick.---------------------22

The lower layers of number 3 are somewhat brecciated, and conspicuously laminated, containing some chert and pyrite, and discolored with limonite. This is immediatly above the Rhinopora

verrucosa and Triplecia ortoni zone. In places the contact between members 2 and 3 is irregular, indicating a period of erosion before the deposition of the Niagaran limestone. The unconformity between the Sexton Creek and Niagaran limestones is very distinct wherever the contact between these two formations is exposed. The Niagaran is more porous than the Sexton Creek limestone and weathers more rapidly, and for this reason there is usually a distinct bench at the top of the Sexton Creek limestone where these strata are exposed in the banks of the streams. There is some evidence of an unconformity between the Edgewood and Sexton Creek limestones, but this is by no means as distinct as that between the Niagaran and Sexton Creek limestones. In all of the Grafton region the Sexton Creek limestone is dolomitized, and very similar in appearance to the Edgewood below and the Sexton Creek limestone above.

The Sexton Creek limestone is well developed in Pike and Calhoun counties, Illinois, and in Pike County, Missouri. The relations and character of the strata are shown in a number of excellent sections.

Section of strata exposed in the south part of the village of Hamburg.

Hamburg.	Feet	Inches
5. (Middle Devonian): Iowa Hamilton; Coarse grained, gray limestone.--	4	
4. (Sexton Creek limestone): Hard, gray limestone, in layers 6 to 30 inches thick, containing many fossils in some zones.---------------------------------------	48	

Members 2 abd 3 are Edgewwod limestone. Feet Inches

3. Yellow to brown limestone which, on weathering, breaks into thin slabs in an almost vertical direction.--16

2. A light gray oolite: (Noix member).---------------3 6

A break in deposition.

1. (Orchard Creek shale): Bluish, plastic shale.--------7

In the forgoing section a zone 12 to 18 inches thick, about 20 feet below the top member number 4., contains many fossils of Triplecia ortoni, Rhinopora verrucosa, Stricklandenia triplesiana, and Stricklandenia n. sp.

In the northeastern part ~~part~~ of the state there are many fine exposures of the Sexton Creek limestone over an area extending from the Kankakee River, north to Elgin on the Fox River.

A section exposed in the east bank of Kankakee River, three and one-half miles above Custer Park, is given below.

Members 2 to 5 are Sexton Creek limestone. Feet Inches

5. Hard, gray, massive limestone, containing many fossils including Stricklandenia n. sp., and Triplecia ortoni.------------------------------------28

4. Thin bedded dolomite.-------------------------------6

An apparent break in deposition.

3. A very dark, reddish, impure limestone, with Pentamerella? manniensis.------------------------------------4 6

2. (Maquoketa, Oolitic iron ore bed): Reddish-brown

	Feet	Inches
impure oolitic iron ore.	4	6
1. (Maquoketa shale): Bluish-gray plastic shale.	8	

The Pentamerella? manniensis zone occurs about three feet below the base of the thin bedded limestone in this region. The strata between the Pentamerella? manniensis zone and the base of the thin bedded limestone consists of a yellowish dolomite, in layers 5 to 8 inches thick. There appears to be a plane of unconformity in this place at the base of the thin bedded Sexton Creek limestone, although the Pentamerella? manniensis zone occurs about three feet below this plane.

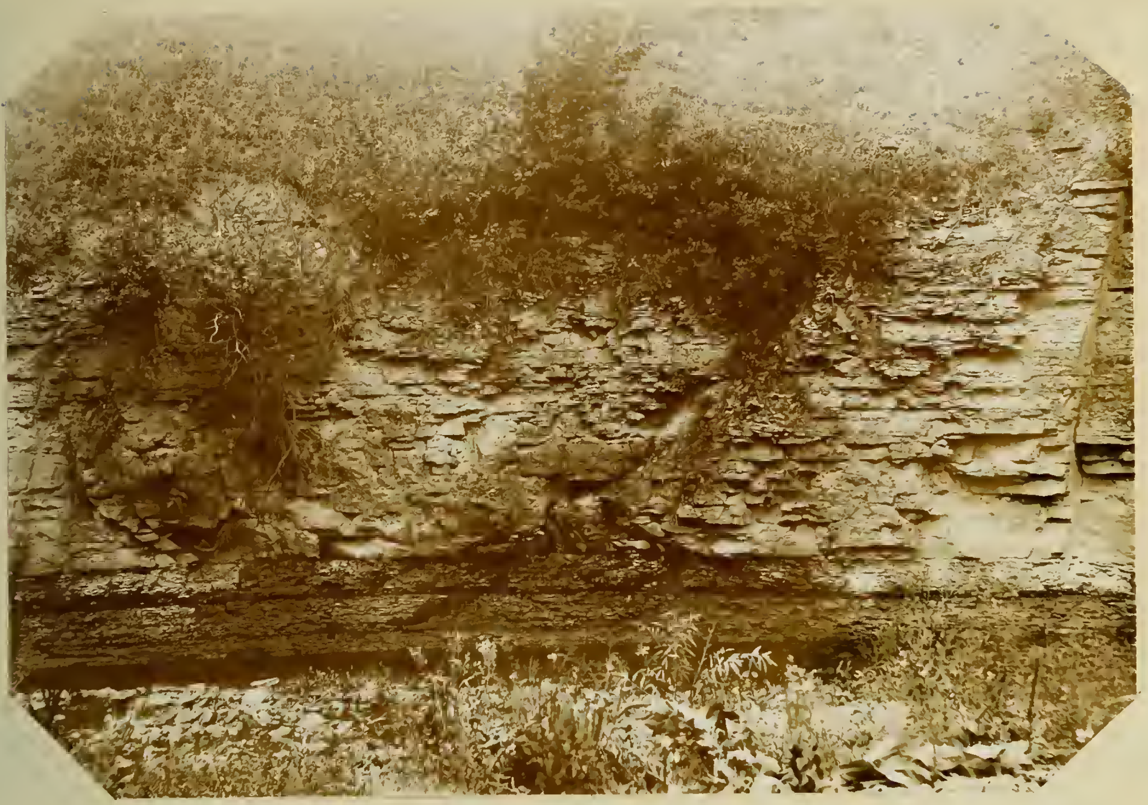
Section of strata exposed about three miles south of Channahon.

	Feet	Inches
3. (Edgewood limestone): Gray crystalline limestone, containing such typical fossils as Lyellia thebesensis Atrypa praemarginalis, Camarotoechia? concinna Dalmanella edgewoodensis, Rhynchotreta thebesensis, and Whitfieldella ovoides.	11	
2. Brown limestone corresponding in part to the limestone described in the old Channahon section.	10	
1. (Maquoketa shale): Bluish plastic shale.	8	

A short distance south of this exposure the lower beds of the Sexton Creek limestone outcrop at a level only a few feet higher than the top of number 3 above.

Section of strata exposed three miles southwest of Channahon.

	Feet	Inches
2. Brown limestone, with typical Edgewood fossils in the lower part.	14	



Exposure two Miles South of Millsdale.

Contact of the Niagaran and the Maquoketa Shale, Showimg Absence of the Sexton Creek Limestone.

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	Feet	Inches
1. A few rods south , and six feet higher than the top of the brown limestone, there occurs a light gray limestone with typical Sexton Creek fossils.	9	

At the place where the earliest described outcrop of Channahon limestone is exposed, in the south bank of the Des Plaines River, the following section was made.

	Feet	Inches
2. (Channahon limestone): Dark gray limestone, in layers 2 to 5 inches thick.	9	
1. (Maquoketa shale): Bluish, plastic shale.	6	

About twenty rods south of the exposure last described, and at a level twenty feet higher , there occurs a bed of light gray limestone of Sexton Creek age, which weathers into thin layers, one to two inches thick, and contains Pentamerella? manniensis.

Over an area of many square miles south and east of Channahon, extending almost to Wilmington, the Sexton Creek limestone is found with little, or no covering of earth. In the vicinity of Millsdale the rocks are Niagaran in age, and not far southwest of this place the Sexton Creek limestone is encountered, but there is no exposure of the contact between the Sexton Creek and Niagaran limestones in this immediate area.

In the vicinity of Oswego there are a number of good outcrops of both the Edgewood and Sexton Creek limestones.

Section of strata exposed along Waubansia Creek, at Oswego.

Feet Inches

5. (Sexton Creek limestone): Gray, undolomitized limestone, containing Stricklandinia n. sp.--------5

Members 3 and 4 are Edgewood limestone.

4. Yellowish to gray limestone, partially dolomitized, weathering into layers 1 to 3 inches thick.--------21

3. Yellowish-brown limestone, partially dolomitized, in layers 1 to 4 inches thick.--------------------5

Members 1 and 2 are Maquoketa shale.

2. Hard, light gray, crystalline limestone, containing Rhynchotrema capax.--------------------------------8

1. Gray, crystalline limestone, with some shaly material.--4

In an old quarry one mile east of Oswego there is exposed a thickness of twenty feet of light gray, fine grained limestone, thin bedded in the upper part, but thicker bedded below. The strata here represent the middle part of the Sexton Creek limestone, and neither the Pentamerella? manniensis nor the Stricklandinia zones are found.

About one and one-half miles north of Oswego, on the west side of the Fox River, there is an exposure of about 18 feet of Sexton Creek limestone, which represents about the same level as that outcropping east of town.

In a quarry in the south part of Batavia, on the east side of Fox River, the yellow dolomite (Niagaran) outcrops to a height of about 14 feet with no Sexton Creek limestone exposed below it.

In a quarry one mile south of Batavia, on the west side of the river opposite the electric power plant, there is exposed 20 feet of yellow, Niagaran dolomite, in layers 5 to 7 inches thick, with with no Sexton Creek limestone at the base.

Section of strata exposed in an old quarry one-half mile south of Batavia.

	Feet	Inches
3. Buff yellow, dolomite, in layers 4 to 8 inches thick, dipping east at an angle of about 8 degrees.---	6	6
2. Gray, cross bedded limestone, with much chert in lens shaped masses, and dipping to the east more strongly than the overlying member.------------------	4	
A marked unconformity.		
1. Gray limestone, weathering into thin layers, probably the uper part of the Sexton Creek limestone.---------	8	

No fossils could be found at this place, but because of the very clear unconformity, and of the differance in the strata, it seems probable that the top of the lowest member, number 1. , of the above section represents the contact between the Niagaran and the Sexton Creek limestones.

Section of strata exposed three-fourths of a mile south of St. Charles.

	Feet	Inches
3. Gray limestone, weathering into thin layers.----------	8	
2. Gray limestone, with many shells of Stricklandinia n. sp.--	1	
1. Gray limestone, weathering into thin layers.---------	11	

Section of strata exposed two miles south of Elgin.

	Feet	Inches
3. Yellow, somewhat dolomitic limestone, weathering into layers 2 to 4 inches thick, the lower part containing Stricklandinia n. sp. and Rhinopora verrucosa.	4	6
2. Gray limestone appearing massive in the ledge, but weathering into 2-to 4-inch layers.	17	
1. Gray limestone much like the last , but with a number of chert bands about 8 feet above the base.	15	

The foreman who op~~p~~erates this quarry reported that the top of the Maquoketa shale was only about 6 feet below the floor of the quarry. The strata described in the foregoing section are all of Sexton Creek age.

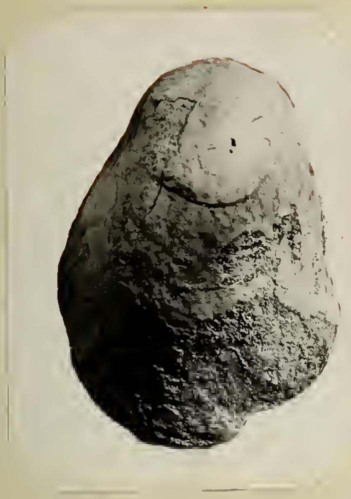
Along Little Turkey River, in Fayette County, Iowa a light gray, non magnesian limestone is exposed in several places between the villages of Waucoma, and Auburn. This limestone rests upon Maquoketa shale, and is succeeded by the Hopkinton dolomite of Niagaran age. It furnished such fossils as Diphyphyllum cf. caespitosum, Rhinopora verrucosa, Atrypa marginalis, Strophonella filistriata, and Dinobolus sp. similar to those found in the Sexton Creek limestone south of Elgin.

At Falling Springs, near Auburn, there is an exposure of limestone, 20 to 30 feet in thickness, which is similar in lithology, and in its fossils to those found in the limestone near Waucoma.

Lithology of the Sexton Creek Limestone.

The Sexton Creek limestone in the Illinois-Missouri region is normally a light gray, finely crystalline, very pure calcium limestone. It is dolomitized at Grafton, and in the northeastern part of the state the upper strata have been locally changed to dolomite. There are numerous thin and very irregular shaly partings of bluish-gray, or greenish color. The upper strata tend to weather into much thinner layers than the lower ones. At certain horizons there are Stromotoperoid zones that may extend across a quarry face in unbroken continuity. Fragments of this limestone from places as far separated as Thebes, Hamburg, and Elgin Illinois, and Fayette County, Iowa, are so similar in appearance that they show the remarkable similarity of these rocks.

In many places the hard, gray limestone phase of this formation is so resistant to the forces of disintegration that weathering seems to consist principally in solution only upon the surface and along the joint planes. At many places along the Mississippi River, where the best outcrops are seen, the Sexton Creek limestone forms very bold cliffs which have very little talus at the base. In the northern part of the state the Sexton Creek limestone forms the bed of Fox River for many miles and is so resistant, that in this part of its course the river has been able to erode only a very shallow channel. In northwestern Iowa, this limestone overlies the Maquoketa shale, and outcrops at a considerable elevation in the hillsides, under which conditions



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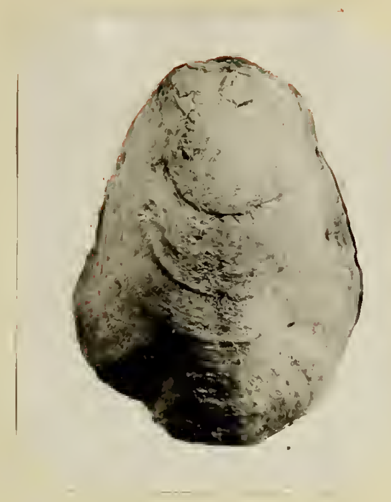

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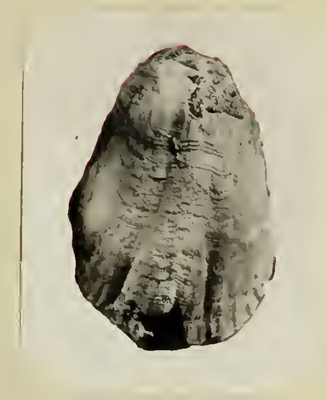

3

Views of Stricklandinia n. sp.(pyriformis) characterizing the upper fossil zone of the Sexton Creek limestone

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there has been much slumping, and great detached blocks of limestone have crept far down the hillsides, and rest upon the more gentle slopes below the top of the Maquoketa shale.

Comparison of Sections.

The Sexton Creek limestone does not contain a great number of fossils, but there are two zones that are well marked by characteristic species. Near the base there is a zone containing many shells of Pentamerella? manniensis. This zone is near the base of the Sexton Creek formation near Custer Park, and Channahon in the northern part of the state, and occurs at a similar horizon in southwestern Illinois. Near the top of the Sexton Creek limestone there is a very persistent fossil horizon, that yields similar species in regions as far separated as Elgin, Custer Park, and Hamburg. The most abundant fossil is a pyriform Pentameroid (Stricklandinia n. sp.), the shells of which make up the greater portion of a layer eight or ten inches thick. With this species there is associated Stricklandinia triplesiana, and less commonly Triplecia ortoni, and Rhinopora verrucosa. The two latter species are rather common in southwestern Illinois, but only a few specimens of Rhinopora verrucosa, and one shell of Triplecia ortoni have been found in the northeastern part of the state.

The most characteristic fossil of the Sexton Creek limestone, above the Triplecia ortoni zone in the Hamburg region, is Spirifer radiatus, and in the middle portion of this formation the most common species of a rather extensive fauna is Orthis flabellites, but in no case are the fossils numerous outside of

the two zones first mentioned.

The difference in lithology of the Sexton Creek limestone at Grafton has already been mentioned, and this difference is accompanied by a slight variation in the fauna, from that of other areas. At Grafton the Triplecia ortoni zone is at the very top of the Sexton Creek limestone, and has been affected by weathering previous to the deposition of the Niagaran dolomite. Here Rhinopora verrucosa, and Triplecia ortoni are common, but Stricklandinia n. sp. is absent, and Clorinda ventricosa is much more common than elsewhere. At Hamburg where the Sexton Creek limestone exhibits the maximum thickness it attains in the Illinois-Missouri region, this Triplecia ortoni zone is about twelve feet below the top of the formation.

In the vicinity of Thebes the Sexton Creek limestone is marked by a number of pecularities. Triplecia ortoni is found in small numbers, together with Stricklandinia triplesiana, but is not accompnied by Strcklandinia n. sp. In the upper part of the section in this region are very massive layers of very fine grained limestone, with a mottled red color. The fossils consist of very minute shells of brachiopods, and orthoceras, and trilobite fragments. The fauna lacks several of the typical Sexton Creek species, but a reference to the comparative list of fossils given below will show that it is Sexton Creek in age.

The fossils are well preserved in the undolomitized, gray, Sexton Creek limestone, and while the casts of fossils from the dolomite phase are less satisfactory for study they are unusually good

A comparative table of the fossils of the Sexton Creek limestone from several localities in the Illinois-Missouri region is given below.

Comparative table of Fossils from the Sexton Creek Limestone.

Localities: Column 1 near Elgin, Illinois, upper beds; column 2, near Elgin, Illinois, lower beds; column 3, near Channahon, Illinois; column 4, near Oswego, Illinois on the east side of Fox River; column 5, near Oswego, Illinois, on the west side of Fox River; column 6, near Custer Park, Illinois; column 7, near Geneva, Illinois; column 8, near Grafton, Illinois; column 9, Fayette County, Ia.; column 10 lower beds near Thebes, Illinois; column 11, upper red beds near Thebes, Illinois; column 12 Hamburg, Illinois.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Actinostroma sp. a.		x	x	x	x	x			x			
Actinostroma sp. b.			x									
Clathrodictyon vesiculosum Nicholson & Murie.			x	x		x			x	x		x
Clathrodictyon sp. a.				x	x							
Clathrodictyon sp. b.				x								
Alveolites sp. a.						x						
Alveolites sp. b.	x	x	x	x								
Aulopora sp.		x										
Cerionites sp.		x										
Chonophyllum belli Billings.		x										
Chonophyllum nymphale Billings.		x	x									
Calostylus spongiosa Foerste.		x			x							

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10	(11	(12
Diphyphyllum caespitosum Hall.						x			x			x
Favosites favosus Goldfuss.		x	x	x	x		x	x		x		x
Favosites favosoidea Hall.		x	x						x	x		
Favosites venustus Hall.	x	x	x	x	x	x	x		x			
Favosites sp.			x	x								
Halysites catenulatus Linnaeus	x	x	x	x	x		x			x		x
Heliolites subtubulatus McCoy.	x	x	x	x	x							
Heliolites sp.				x	x							
Lyellia americana Edwards & Haime.		x		x						x		
Lyellia sp.		x		x		x	x			x		x
Polyorophe sp.		x		x								
Streptelasma sp. a.			x									
Streptelasma sp. b.		x		x	x	x		x	x			
Streptelasma sp. c.					x	x			x			
Streptelasma sp. d.					x							
Syringolites cf. huronensis Hinde.		x	x	x	x	x						x
Syringopora sp.		x					x					x
Syringostroma sp.						x						x
Thecia minor Rominger.		x	x	x	x	x						x
Zaphrentis sp. a.		x										
Zaphrentis sp. b.		x							x			
Nov. Gen. nov.sp.	x	x		x	x							
Callopora sp.						x						x
Clathropra frondosa Hall.						x						
Fenestella sp.						x						x

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	10	(11	(12)
Rhinopora verrucosa Hall.	x		x			x		x	x	x		x
Rhinopora sp.												x
Atrypa marginalis Dalman.	x	x	x		x		x		x	x	x	
Atrypa reticularis Linnaeus.		x	x		x			x				
Atrypa sp.								x				
Bilobites bilobus Linnaeus.					x							x
Camarotoechia convexa Foerste.					x	x						x
Camarotoechia neglecta Hall.	x	x						x	x			x
Camarotoechia sp.												x
Clorinda ventricosa Hall.								x				
Clorinda sp.			x			x		x				x
Dalmanella elegantula Dalman.		x	x		x	x	x	x		x	x	x
Dalmanella sp.	x					x						x
Dinobolus sp.	x								x			
Gypidula sp.			x									
Hebertella sp.									x			
Leptaena rhombodalis Wilckens.	x	x	x		x	x		x	x	x		x
Orthis flabellites Foerste.	x	x	x	x	x	x	x	x	x	x		x
Orthis fausta Foerste.		x										x
Pentamerus oblongus Sowerby.	x	x				x						x
Pentamerus ovalis Hall.	x	x	x		x	x						x
Pentamerus sp.						x						
Parastrophia cf. ops Billings.				x								
Pentamerella? manniensis Foerste.			x			x		x				
Platystrophia daytonensis Foerste.		x	x		x	x		x	x	x		x

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10	(11	(12)
Platystrophia reversata Foerste		x				x		x		x		x
Plectambonites transversalis var. elegantula Foerste.	x					x		x	x	x	x	x
Rhynchotreta sp.									x			
Schuchertella tenuis Hall.								x	x			
Schuchertella subplana Conrad.		x	x									
Schuchertella sp.					x				x			
Schizotreta tenuilamellata Hall.								x				
Spirifer radiatus Sowerby.												x
Stricklandinia triplesiana Hall	x		x		x	x	x	x		x		x
Stricklandinia sp. a.	x	x	x		x	x	x		x			x
Stricklandinia sp. b.	x								x			
Strophonella filistriata Foerste		x				x			x			x
Strophonella profunda Hall.			x				x					
Strophonella striata Hall.	x	x						x	x			
Triplecia ortoni Meek.						x		x		x		x
Whitfieldella intermedia Hall.								x	x			
Cyclonema daytonensis Foerste.	x		x		x			x	x	x		
Bellerophon sp.			x									
Diaphorostoma niagarensis Hall.	x	x	x	x	x	x	x	x	x	x		x
Euomphalus sinuatus Hall.		x			x							
Murchisonia sp.		x	x									
Platyceras niagarensis Hall.								x				
Straparollus incarinatum Foerste.	x		x							x	x	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10	(11	(12)
Cyrtoceras subcompressum Beecher.			x	x								
Orthoceras sp.		x		x			x			x		
Cornulites distans Hall.								x				
Bronteus acamus Hall.						x		x				x
Calymene vogdesi Foerste.		x		x				x		x	x	
Ceraurus cf. niagarensis Hall.						x						x
Encrinurus sp.						x		x		x	x	x
Illaenus daytonensis Hall & Whitfield.		x	x		x	x		x		x	x	x
Illaenus imperator Hall.								x		x		
Illaenus madisonensis Whitfield		x				x		x		x		x
Illaenus sp. a.		x			x		x					
Illaenus sp. b.		x			x		x					
Proetus determinatus Foerste.											x	
Sphaerexochus pisum Foerste.										x	x	

The following table will give the comparison of the fossils of the Sexton Creek limestone in Illinois, with the Brassfield limestone in Ohio and Kentucky.[32]

Comparative Table of Fossils from the Illinois, Ohio, and Kentucky Regions.

Localities: Column 1, from the Kentucky region; column 2, from the Illinois region; column 3, from the Ohio region.

	(1)	(2)	(3)
Actinostroma sp.a.	x	x	
Actinostroma sp. b.		x	
Clathrodictyon vesiculosum Nicholson &Murie.		x	x
Clathrodictyon sp. a.		x	
Clathrodictyon sp. b.		x	
Dictyonema pratense Foerste.			x
Dictyonema scalariforme Foerste.			x
Alveolites sp. a.		x	
Alveolites sp. b.		x	
Aulopora prisca Hall.			x
Acevularia clintonensis Nicholson.			x
Cerionites sp.		x	
Chonophyllum belli Billings.		x	
Chonophyllum nymphale Billings.		x	
Calostylus spongiosa Foerste.	x	x	
Cyathophyllum calyculum Hall.	x		x

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[32] Aug. F. Foerste; Bull. sci. Lab's. Denison Univ. vol.iii.pp1-12
Ohio Geol.Surv. vol.vii, pp516-601..Ky. Geol. Surv. Bull. 7 p27

	(1)	(2)	(3)
Cyathophyllum celator Hall.			x
Diphyphyllum caespitosum Hall.		x	x
Favosites favosus Goldfuss.		x	x
Favosites favosoidea Hall.		x	x
Favosites niagarensis Hall.	x	x	x
Favosites venustus Hall.	x	x	x
Favosites sp.		x	
Halysites catenulatus Linnaeus.	x	x	x
Heliolites subtubulites McCoy.	x	x	x
Heliolites sp.		x	
Lyellia americana Edwards & Haime.		x	
Lyellia sp.		x	
Ptychophyllum ipomea Foerste.	x		
Polyorophe sp.		x	
Protarea? sp.		x	
Striatopora flexuosus Hall.			x
Syringopora fascicularis Foerste.			x
Streptelasma hoskinsoni Foerste.			x
Streptelasma geometricum Foerste.			x
Streptelasma obliquus Foerste.			x
Streptelasma sp. a.		x	
Streptelasma sp. b.		x	
Streptelasma sp. c.		x	
Streptelasma ap. d.		x	
Syringopora sp.		x	
Syringolites cf. huronensis Hinde.	x	x	x

	(1)	(2)	(3)
Zaphrentis daytonensis Foerste.			x
Zaphrentis sp. a.		x	
Zaphrentis sp. b.		x	
Thecia minor Rominger.		x	
Nov. Gen. nov. sp.		x	
Anoplotheca saffordi Foerste.			x
Anoplotheca hemispherica Sowerby.			x
Aspidopora parvula Foerste.			x
Callopora elegantula Hall.			x
Callopora magnopora Foerste.			x
Ceramopora expansa James.			x
Clathropora frondosa Hall			x
Clathropora clintonensis Hall & Whitfield.			x
Fenestella sp.		x	x
Hemitrypa ulrichi Foerste.			x
Homotrypa confluens Foerste.			x
Lioclemella ohioensis Foerste.			x
Rhinopora frondosa Foerste	x		
Rhinopora verrucosa Hall.		x	x
Phylloporina angulata Hall.			x
Phylloporina sp.		x	x
Phaenopora ensiformis Hall.			x
Pachydictya fimbricata James.			x
Pachydictya expansa Hall & Whitfield.	x		x
Pachydictya magna Hall & Whitfield.			x
Pachydictya multifida Foerste.			x

	(1)	(2)	(3)
Pachydictya crassa Hall.			x
Pachydictya lanceolata Goldfuss.			x
Phaenopora expansa Hall & Whitfield.	x		x
Phaenopora magna Hall & Whitfield.			x
Phaenopora multifida Hall.			x
Phaenopora fimbricata James.			x
Phaenopora ensiformis Hall.			x
Ptilodictya whitfieldi Foerste.			x
Stictopora similis Hall.			x
Trigonodictya eatonensis Ulrich.			x
Atrypa lati-corrugata Foerste.			x
Atrypa marginalis multistriata Foerste.			x
Atrypa reticularis Linneaus.			x
Bilobites bilobus Linnaeus.		x	
Camarotoechia convexa Foerste.		x	x
Cameroteochia neglecta Hall.			x
Camerotoechia scobina Meek.	x		x
Clorinda ventricosa Hall.		x	
Clorinda sp.		x	
Craniella clintonensis Foerste.			x
Dalmanella elegantula Dalman.	x	x	x
Dinobolus sp.		x	
Eichwaldia reticulata Billings.		x	x
Gypidula sp.		x	
Hebertella daytonensis Foerste.			x
Hebertella fissistriata Foerste.			x

	(1)	(2)	(3)
Hebertella fissicata Hall.			x
Hebertella sp.		x	
Hindella umbonata Billings.			x
Leptaena rhomboidalis Wickens.	x	x	x
Orthis flabellites Foerste.	x	x	x
Orthis interplicata Foerste.			x
Parastrophia sparsiplicata Foerste.			x
Parastrophia cf. ops Billings.		x	
Pentamerus oblongus Sowerby.	x	x	
Pentamerus ovalis Foerste.	x	x	x
Pentamerus sp.		x	
Pentamerella? manniensis Foerste.	x	x	
Platystrophia daytonensis Foerste.	x	x	x
Platystrophia reversata Foerste.	x	x	x
Plectambonites transversalis Wahlenberg.		x	x
Plectambonites transversalis var. elegantula Foerste.	x	x	x
Plectambonites alabamensis Foerste.			x
Plectambonites prolongata.Foerste.			x
Rhynchonella? decemiplicata Sowerby.			x
Rafinesquina obscura Hall.			x
Rhipidomella hybrida Sowerby.			x
Schuchertella subplana Conrad.		x	
Schuchertella daytonensis Hall.			x
Schuchertella fissiplicata Foerste.	x		
Schuchertella cf. tenuis Foerste.	x	x	x

	(1)	(2)	(3)
Schuchertella sp.		x	
Schizotreta tenuilamellata Hall.		x	x
Stricklandinia triplesiana Hall.	x	x	x
Stricklandinia planus Foerste.			x
Stricklandinia dichotoma Foerste.	x		
Stricklandinia sp. a.		x	
Stricklandinia sp. b.		x	
Strophonella filistriata Foerste.		x	x
Strophonella profunda Hall.		x	
Strophonella striata Hall.		x	x
Stropheodonta corrugata Sowerby.			x
Stropheodonta corrugata var. pleuri-striata Foerste.			x
Spirifer radiata Sowerby.		x	x
Triplecia ortoni Meek.	x	x	x
Whitfieldella subquadrata Foerste.	x		
Whitfieldella intermedia Hall.			x
Whitfieldella sp.		x	
Avicula whitfieldella Foerste.			x
Bellerophon exiguus Foerste.			x
Bellerophon opertus Foerste.			x
Bellerophon fiscello-striata Foerste.			x
Bellerophon trilobatus Foerste.			x
Bellerophon sp.		x	
Cyclonema daytonensis var. varicosum Foerste.			x
Cyclonema daytonensis Foerste.		x	x
Cyclora alta Foerste.			x

	(1)	(2)	(3)
Crytolites youngi Foerste.			x
Diaphorostoma niagarensis Hall.		x	
Euomphalus sinuatus Hall.		x	x
Holopea obsoleta var. elevata Foerste.		x	x
Liospira affinis Conrad.			x
Murchisoni sp.		x	
Platyceras niagarensis Hall.		x	x
Pleurotomaria labrosa var. occidens Hall.			x
Pleurotomaria filistriata Foerste.			x
Straparollus incarinatum Foerste.		x	x
Subulites directus Foerste.			x
Subulites plani-lateralis Foerste.			x
Conularia bilineata Foerste.			x
Conularia niagarensis Hall.			x
Cypricardites caswelli Foerste.			x
Cypricardites undulostriata Foerste.			x
Modiolopsis rhomboidea Hall.			x
Modiolopsis subrhomboidea Simpson.			x
Mytilarca multiformis Foerste.			x
Nuculites ferrugineum Foerste.			x
Pterinea brisa Hall.			x
Tellinomya clintonensis Foerste.			x
Tellinomya aequilatera Hall.			x
Tellinomya elliptica Hall.			x
Tellinomya socialis Foerste.			x
Tellinomya mimina Foerste.			x

	(1)	(2)	(3)
Coleolus clintonensis Foerste.			x
Cyrtoceras subcompressum Beecher.			x
Cyrtoceras clintonensis Foerste.			x
Cyrtoceras dardanum? Hall.		x	
Gomphoceras inceptum Foerste.			x
Gomphoceras inceptum var. acceleratum Foerste.			x
Gomphoceras amycus Hall.			x
Gomphoceras crawfordi Foerste.			x
Gomphoceras clavatum Foerste.			x
Gomphoceras conchoideum Foerste.			x
Gomphoceras daytonensis Foerste.			x
Gomphoceras hanoverensis Foerste.			x
Gomphoceras ignotum Foerste.			x
Gomphoceras jamesi Hall & Whitfield.			x
Gomphoceras lati-mimmulatum Foerste.			x
Gomphoceras rectum Worthen.			x
Gomphoceras turgido-mimmulatum Foerste.			x
Gomphoceras virgulatum Hall.			x
Gomphoceras novo-carlislensis Foerste.			x
Gomphoceras youngi-Foerste.			x
Cornulites distans Hall.		x	x
Cornulites serpularius clintoni Hall.			x
Acidapsis ortoni. Foerste.			x
Acidapsis brevispogiosa Foerste.			x
Bronteus acanus Hall.		x	
Cyphaspis clintonensis Foerste.			x
Ceraurus clintonensis Foerste.			x

	(1)	(2)	(3)
Calymene niagarensis Hall.	x		x
Calymene vogdesi Foerste.	x	x	x
Dalmanites werthernii Foerste.			x
Deiphon pisum Foerste.			x
Encrinurus punctatus Wahlenberg.			x
Encrinurus ornatus Foerste.			x
Encrinurus sp.		x	
Illaenus daytonensis Hall & Whitfield.		x	x
Illaenus madisonensis Whitfield.			x
Illaenus ambiguus Foerste.			x
Illaenus insignis Hall.			x
Illaenus madisonensis var, elongata Foerste.			x
Illaenus madisonensis var. depressus Foerste.			x
Illaenus sp.a.		x	
Illaenus sp. b.		x	
Illaenus sp. c.		x	
Illaenus imperator Hall.		x	x
Proteus determinatus Foerste.		x	x
Sphaerexochus pisum Foerste.		x	x
Elpe ulrichi Foerste.			x

THE ALEXANDRIAN SERIES IN EASTERN WISCONSIN.

Distribution.

The area in eastern Wisconsis occupied by Silurian rocks is more than 40 miles wide, extending from Lake Michigan on the east to the Silurian escarpment on the west, and has a total length of over 200 miles, extending from the Illinois-Wisconsin state line on the south, to Washington Island at the north end of the Green Bay Peninsula. The lower part of the Silurian limestone, comprising the Alexandrian series, which is included in this study, outcrops in places over a narrow strip along the western edge of the area described above.

Physiography of the Region.

The topography of this region is marked by two major features. The first is the remarkable valley, extending nearly north and south, which is bounded on the east by the Silurian escarpment. The rocks of eastern Wisconsin dip to the east at an angle of about 60 feet to the mile, so that from the east towards the west successively older rocks are exposed at the surface. The Silurian rocks are all hard, resistant, dolomitic limestones, and the underlying Maquoketa shale, which is exposed immediatly west of the Silurian area, is for the most part a soft, very easily eroded shale. It is very probable that in preglacial times the relations, character, and structure of these formations resulted in the development of a valley over the belt in which the Maquoketa shale reached the surface, for it seems certain that the Silurian

escarpment was largely developed in preglacial times. During the glacial periods the ice movement in this region was in the direction of the strike of the strata, and, as a result, the Maquoketa shale was further scoured out and the valley greatly deepened by ice movement. The valley floor is here formed of Galena-Trenton rocks covered with a rather thin mantle of glacial material. From Fon Du Lac north, the land slopes to the east to the very base of the Silurian escarpment. The most northern part of the valley is occupied by the waters of Green Bay. From the southern end of Green Bay to Lake Winnebago it is occupied by the valley of Fox River. Lake Winnebago is a shallow depression in this valley, with a length of about thirty-two miles. From Fon Du Lac the valley can be easily followed southwestward for about 18 miles, to a point about 6 miles west of Waupun. From this point it extends nearly south for about 12 miles to Horicon. This area between Waupun and Horicon is the site of an old lake similar to Lake Winnebago, but smaller in size. The site of the old lake, which is now mostly drained, is marked by the great Horicon marsh. Continuing southwest the valley is less distinct, but is easily traceable to a point nearly west of Milwaukee where it is finally obliterated by the Kettle Range.

The second topographic feature of this area is the "Kettle Range", which is a medial moraine formed along the adjacent borders of the Green Bay and Michigan lobes during the late Wisconsin stage of glaciation. The Green Bay lobe entered the region from the north by way of Green Bay and followed the great valley just described, while the Michigan lobe came from the east and northeast across Lake Michigan. The Kettle Range is marked by a range

of round topped hills composed of gravelly material. It begins a short distance west of the south end of Green Bay, and extends south and a little west at a distance of about twenty miles west from, and nearly parallel with the shores of Lake Michigan. West of Milwaukee the range bends sharply towards the southwest, and crosses the western boundry of the Silurian rocks.

In southwestern Wisconsin the rocks are rather heavily covered with glacial material. The till is a dark red, gravelly clay, and the morainal material is composed of gravel and small boulders, which consist for the most part of local material. The topography is marked by considerable relief, and all of the hills have rounded tops, some of them having more or less circular or oval outlines, while others are ridges extending parallel with the lines of ice movement. In many cases the areas between the hills are occupied by marshes or swamps.

The streams of the region have a very small rate of fall and meander through these swamps. This small gradient has resulted in a very small amount of erosional work by most of the streams, and a majority of the rock outcrops of the region are the result of preglacial and glacial, rather than post-glacial, forces.

In the Green Bay peninsula the glacial material overlying the Silurian rocks is very thin. In a large part of this region the ice sheet seems to have swept the rock surface nearly clean, the very thin soil being the result of post glacial rock decay, and the deposition of a small amount of wind blown material.

Description of the Mayville Limestone.

In his description of the Silurian rocks of Wisconsin Chamberlin[33] makes the following statements in regard to the various Silurian strata developed in the different parts of the region.

"There is such a differance in the Silurian beds in the northern and southern parts of the area, as to justify their being named, described, and mapped separately". These subdivisions are as follows.

Niagara Group.

At the South.	At the North.
1. Guelph Beds	1. Guelph Beds.
2. Racine Beds	2. Racine Beds
	3. Upper Coral Beds
3. Waukesha Beds	4. Lower Coral Beds
	5. Byron Beds
4. Mayville Beds	6. Mayville Beds

Of these subdivisions only the Mayville and the Byron represent beds of Alexandrian age, and hence only these will be discussed in the present paper.

Chamberlin describes the Mayville with considerable detail and the following descriptions are taken from his report[34].

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[33] T. C. Chamberlin: Geol. of Wis. vol. II. 1873-1877, p. 335

[34] Ibid. p. 336

"As already indcated these beds form the lowest member of the Niagara series through its whole extent. They possess the same characteristics throughout their entire area, and in this respect differ from the rest of the group. The rock of this member is, in general, a rough, coarse, gray, magnesian limestone. There is considerable difference, however, among the several layers that compose it. These maintain their pecularities with great persistancy, so that it is possible to distinguish them at points one hundred miles or more apart. This makes it possible to describe a section which will be applicable in a general way to the formation at all points.

"The lowest stratum consists of four to ten feet of shaly, impure limestone usually of a yellowish-gray, but sometimes of greenish hue. * * * * Upon this lies a stratum of hard, heavily bedded, magnesian limestone, usually gray in color, and generally characterized by prominent vertical fissures and distinct bedding joints. * * * * The third general stratum is composed of three parts, as found in most places. The lower one consists of broken fragments of limestone imbedded in greenish, bluish-yellowish, marly clay. More or less chert is present. The middle portion consists of compact, sometimes cherty, limestone, in even beds from four to fourteen inches thick. * * * * The upper portion is a repetition of the lower. * * * * This stratum is overlain by an even bedded limestone, usually quite hard, compact, fine grained, white or light gray. * * * * Upon this rests a stratum similar to the second in being characterized by thick beds, and vertical

fissures, but differing from it in being less hard, and in possessing a brecciated structure in some localities. To the position just above this is to be referred a layer containing many obscure casts of a Pentamerus (Gypidula), very similar to occidentalis, This stratum is succeeded above by a white, even textured limestone of the Byron and Waukesha beds."

"As a whole the Mayville may be easily recognized by the thick bedding, uneven structure, and rough, craggy, pitted surface of the weathored ledges. * * * * It is the best exposed member of the Niagara group, and it forms a chain of craggy cliffs, upwards of a hundred miles in length, though broken down and concealed at frequent intervals. The greatest observed thickness is one hundred feet. The average thickness is probably not less than sixty feet." * * * *

"Life-The remains of the life of the period are very illy preserved, and it is only rarely that fossils can be found sufficiently well-defined to be satisfactorily identified. In most cases only obscure casts remain. It is not to be inferred from this however that the life of the period was actually meager. On the contrary it was probably abundant." * * * *

Description of the Bryon Limestone.[35]

"Reposing upon the coarse textured Mayville beds, last described, lies a somewhat thicker series of beds, bearing a strong contrast to them in color, texture, stratification, and general character". * * * *

[35] T. C. Chamberlin: Geol. of Wis. vol. III, 1873-1877, p. 345

"To describe them somewhat more precisely, it may be remarked, that the color, where not white, is a light gray or cream tint, sometimes lined or mottled with pink in a very handsome manner. The texture is usually very close or compact, and very fine grained. * * * *

Chamberlin believes that the different beds comprising the whole Silurian section of this part of the state, are but different phases of the Niagaran. This opinion seems to be based very largely upon the undoubted fact that there is no unconformity to be observed in the entire Silurian section of this area. The division of the Mayville and Byron beds is made entirely on the basis of lithology.

Detailed Sections.

The following detailed sections will show the character, and relationships of the basal, Alexandrian members of the Silurian system in eastern Wisconsin.

Outcrop near Eagle

One and one-half miles southwest of the village of Eagle, and extending almost continuously to Jericho, there is a much weathered outcrop of massive gray dolomite, having a maximum thickness of thirty feet, which weathers into very irregular masses. The underlying Maquoketa shale is not exposed in this part of the state.

Outcrop near Hartford.

In the north part of the city of Hartford there is a small outcrop of the lower beds of the Silurian, and in the southern part of the city the oolitic iron ore is found. From the record

of strata penetrated in digging wells and cellars, it appears that the iron ore is six to eight feet thick in this region.

Sections of strata exposed south of Lake Pewaukee.

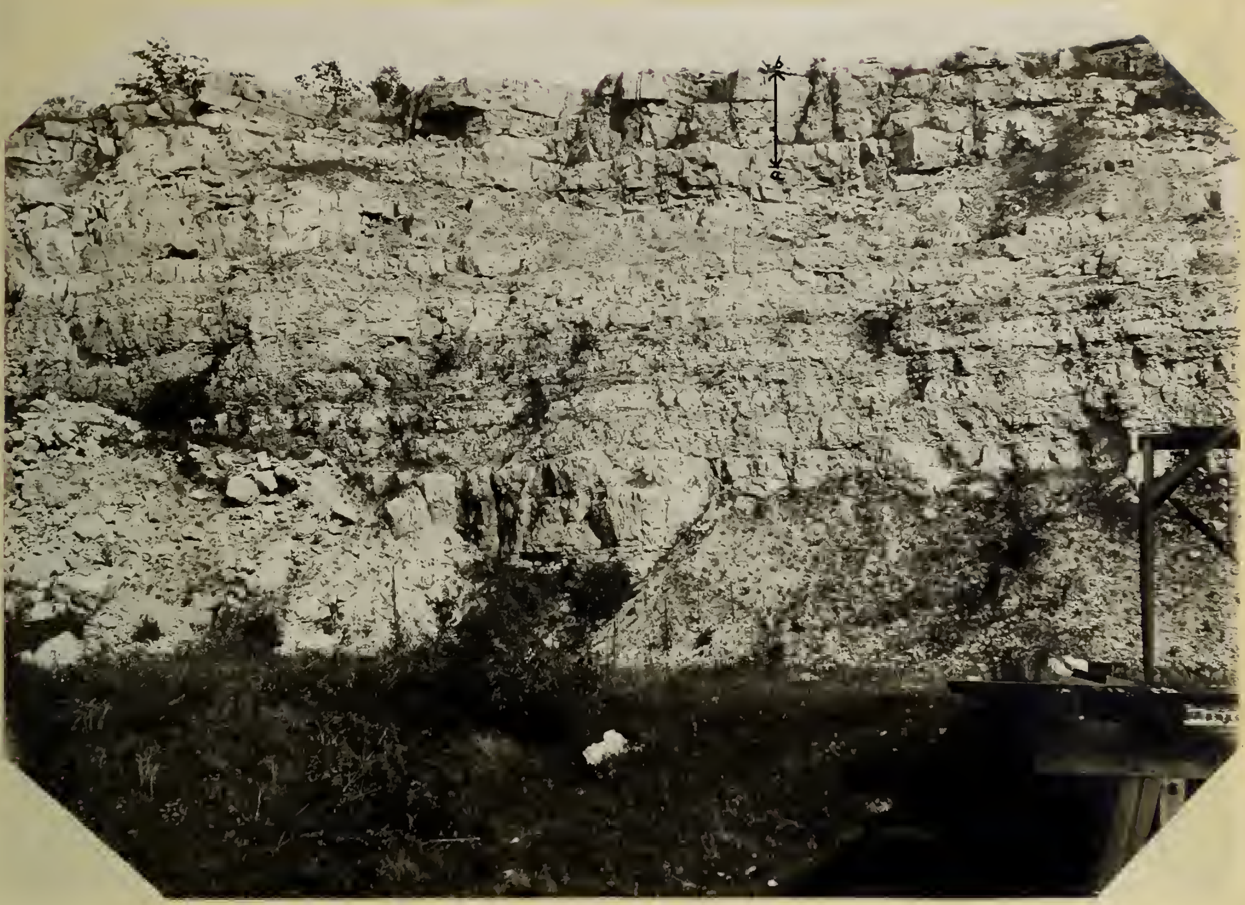
Along the line of the electric railway, a short distance east of Elmhurst, there is a good outcrop of limestone, and near the Salem School, three-fourths of a mile south of Elmhurst, are two old quarries. One of these is the old Gray Quarry, which was formerly opened down to the Maquoketa shale, but which is now covered with debris. In the eastern part of the village of Delafield there is exposed in an old quarry about twenty feet of gray dolomite. In the northeastern part of the village of Pewaukee a thickness of about twelve feet of the same limestone is exposed. At all of these localities all of the exposed horizons are part of the Mayville beds of the Silurian, but the outcrop south of Elmhurst is the only one known to extend down to the Maquoketa shale.

Sections of strata exposed near Mayville.

The Mayville limestone is well exposed three miles south of the city of Mayville, in a bluff about one hundred feet high.

Feet

5. Thick bedded, porous, dolomitic limestone, in layers 2 to 6 feet thick, which are honeycombed by the great number of the casts of fossils, (Virgiana barrandei var.)---------------------------20
4. Hard, dolomitic limestone, with many irregular cavities, and containing smaller numbers of the same fossil as occurs in number 5 above.------------11
3. Thick bedded, hard, crystalline dolomite, with



Outcrop of Mayville Limestone, Three Miles South of Mayville, Wisconsin.

Total height of exposure about 100 feet: Virgiana barrandei var. zone extends from a. to b., indicated by arrow near the top of the plate.

Feet

many cavities, in layers 4 to 6 feet thick.------------------33

2. Thin bedded,fine grained dolomite, in layers 4 to 16 inches thick.-----------------------------------32
1. Hard,crystalline dolomite, with irregular cavities, resembling number 3 above.-------------------------------22

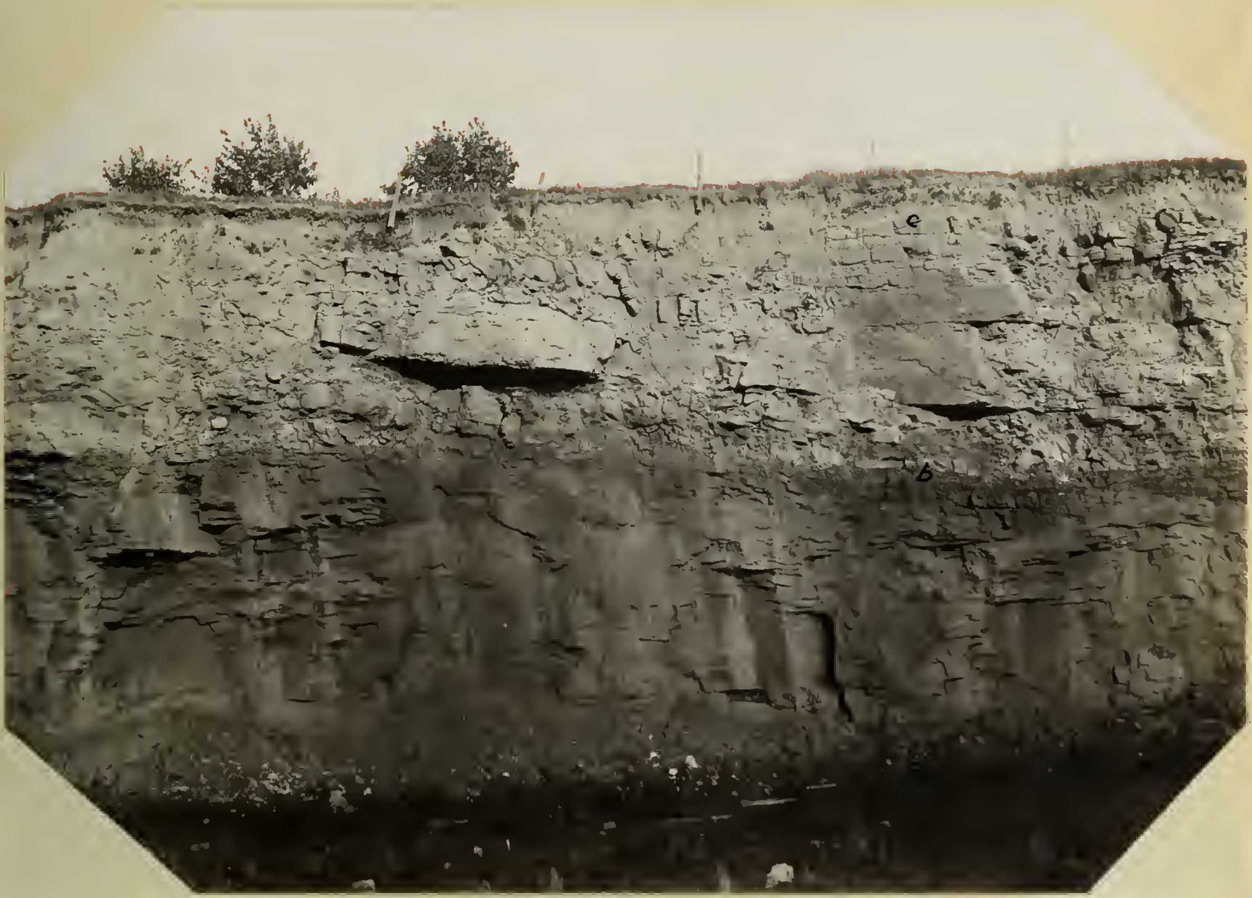
Section of strata exposed in a quarry four miles south of Mayville.

7. Fine grained, gray, compact, crystalline dolomite, in rather even layers,---------------------------------40 Feet
6. Dolomitic limestone, coarser than the last, in layers 1 to 2 feet thick.---------------------------------21

Members 6 and 7 form the upper bench of the quarry. The limestone varies greatly in appearance, in some places being quite red, in others buff, and in other parts blue-gray, or nearly white. There are many clay pockets and some clay seams. The texture varies geatly and may be coarsely crystalline or nearly lithographic, in structure.

5. Dense, fine grained, gray, crystalline dolomite.--------2
4. Porous,granular, yellow, dolomitic limestone, with great numbers of fossils, (Virgiana barrandei var.)-----16
3. Compact, crystalline, gray to pink dolomite, with fewer fossils of the same brachiopod as in number 4 above.--12
2. Compact, gray to pink,crystalline dolomite like number 3 above,but without fossils.---------------------10
1. Fine grained dolomite, very evenly bedded.---------------30

In the above section numbers 3 and 4 correspond to numbers 4 and 5 in the last section. Beginning at the top of number 4, a



Exposure in Iron Mine, at Neda,Wisconsin

Maquoketa oolitic iron ore extending from a. to b. in the lower half of the plate: distinct unconformity at b.: basal portion of the Mayville limestone extending from b. to c. in the upper half of the plate.

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well in this quarry penetrated 90 feet of limestone without reaching Maquoketa shale.

The following section was made of the iron ore workings at Neda.

	Feet
6. Gray. crystalline limestone, with many cavities, in layers 1 to 2 feet thick.	12
5. Gray dolomite, in thin layers with clay bands.	6
4. Irregular beds of dolomite, in layers 1 to 2 feet thick.	18
A well defined unconformity.	
3. Nearly black, impure iron ore, breaking with a nearly conchoidal fracture.	1
2. Brownish-red, evenly bedded, oolitic iron ore, showing very perfect cleavage along the bedding planes.	12 to 20
1. Maquoketa shale.	8

All of the lower part of the limestone in the above exposure is much stained with iron oxide, but this is only along the joint planes, and lining the surface of cavities. The limestone in this section corresponds to the limestone in the lower part of the section three miles south of Mayville.

Section of rocks outcropping one mile north of Neda.

	Feet
5. Red till, composed of a minor portion of glacial gravel and a major portion of oolitic iron ore.	8
4. Coarse grained, thick bedded, dolomitic limestone.	20
3. Fine sand, containing some iron ore.	1
2. Hard, black, impure iron ore.	1
1. Oolitic iron ore.	16

The iron ore at this place is rather soft, and quickly breaks down into an earthy mass when exposed to the air. In the

lower part of the iron ore bed are numerous very irregular masses of red, shaly appearing material, having concentric films of iron oxide on the surface.

Section of strata exposed one mile south of Oakfield.

Feet

4. Thin bedded, gray, dolomitic limestone, with numerous small cavities.---12
3. Thick bedded limestone, otherwise like the last.----------44
2. Thick bedded, compact, fine grained, dark red, dolomitic limestone.------------------------------------6

A break in sedimentation.

1. Light gray, friable shale, with many fossils in the upper part.---50

The limestone here contains no fossils, as the fossil horizon presented at Mayville belongs to a higher level than the top of this section.

Section of strata outcropping at Marblehead.

East quarry.

7. Thick bedded, coarse grained, dolomitic limestone, containing the fossil zone of (Virgiana barrandei var)----12
6. Concealed zone, covered with soil.--------------------------40
5. Thick, irregular beds of gray crystalline dolomite.-------21
4. Fine grained, gray dolomite, in even layers 4 to 6 inches thick.---12
3. Like the last, except that the beds are 1 to 8 inches thick.30
2. Limestone penetrated by the drill, but not exposed.--------58
1. Maquoketa shale.---

Second quarry one-fouth mile east of the last.

Feet

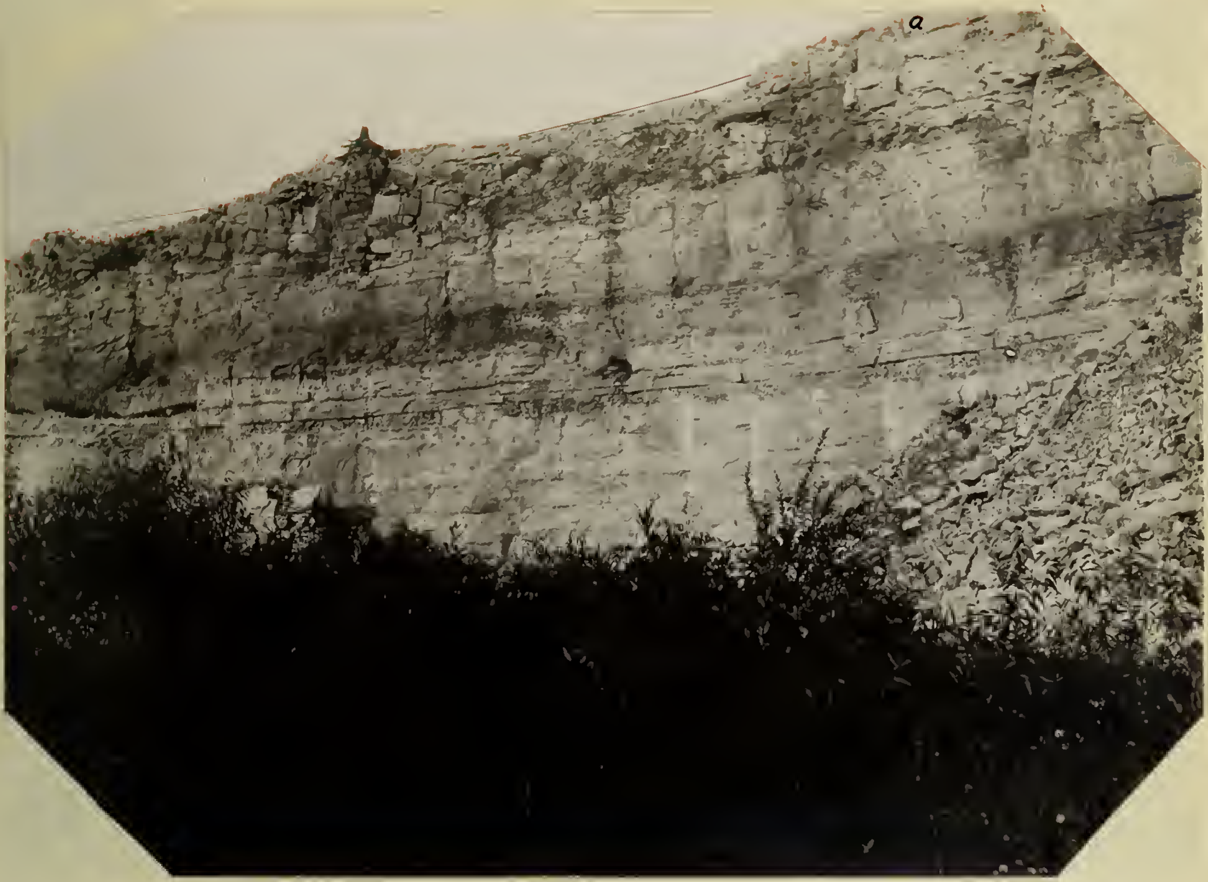
6. Very thick layers of coarsly crystalline dolomite, mottled gray and brown.----------------------------------6
5. Porous, coarsely crystalline dolomite, in layers up to 4 feet thick, full of the fossil (Virgiana barrandei var.)--25
4. Thick irregular layers of coarse grained dolomite.-----44
3. Thin even layers of fine grained dolomite.-------------12
2 Limestone penetrated by drill,but not exposed.---------88
1. Maquoketa shale.--

Section of strata exposed in an old quarry one half mile south of Peebles.

Feet

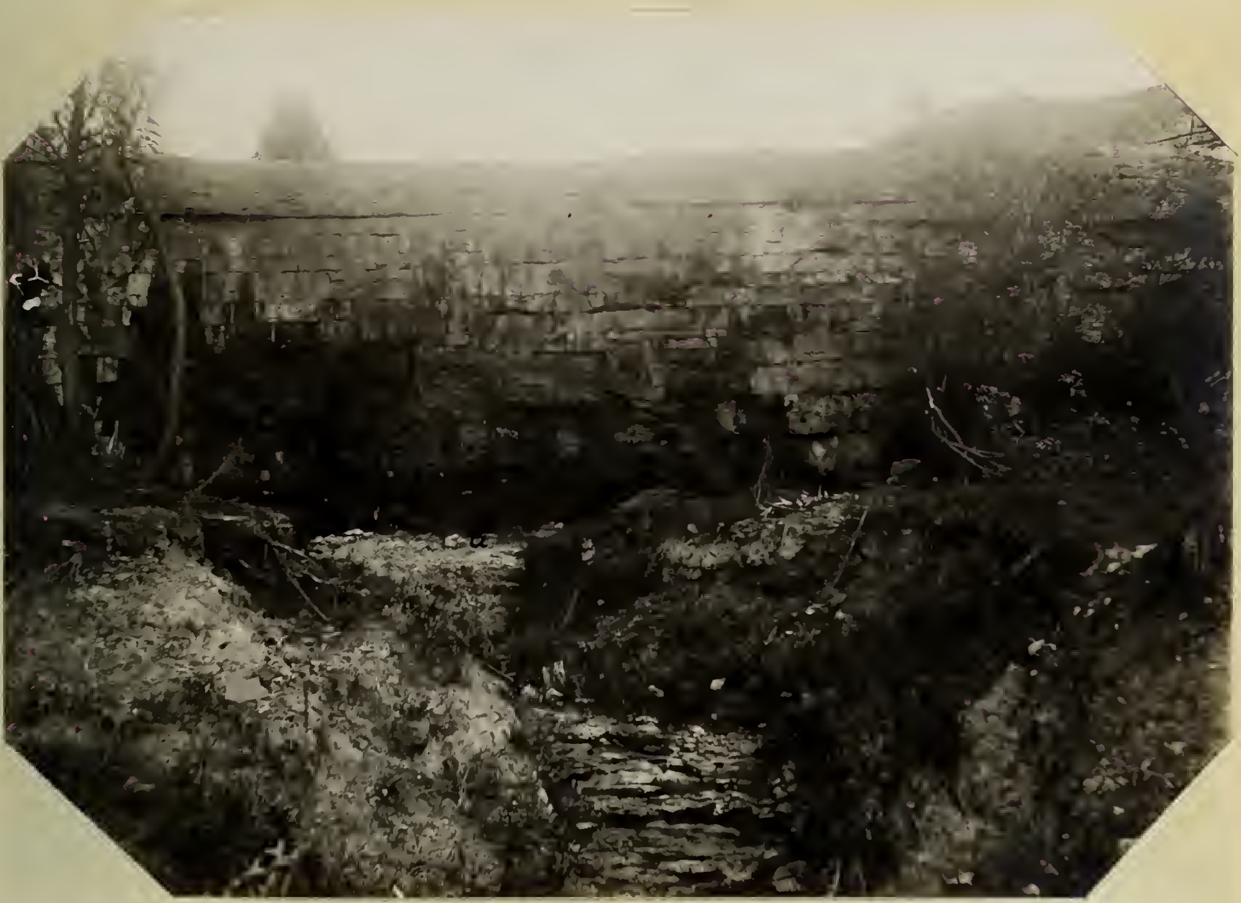
5. Hard,coarsely crystalline dolomite, with many cherty nodules, and containing a few fossils.-----------------6
4. Hard, porous, pinkish-brown dolomite, in layers up to six feet thick.---------------------------------20
3. Dolomite in irregular, thick layers, with cavities.---10
2. Thin, very irregular layers of dark gray dolomite, with nearly continuous separating bands of chert.------3
1. Dark gray dolomite,in thicker layers, with fewer chert nodules than the last. ---------------------------------20

That the top of the Maquoketa shale is near the lower stratum of the limestone exposed in the Peebles quarry is indicated by the fact that springs issue at the base of the quarry. The contact of the Maquoketa shale and the overlying Mayville lime-



Quarry in the Mayville Limestone, One-half Mile South of Peebles, Wisconsin.

The point a. near the top of the plate indicates the horizon where the silicified Edgewood fossils occur.



Contact of the Mayville limestone and the Maquoketa shale, near Peebles, Wisconsin.

Maquoketa shale from the bottom of the plate to a.: Mayville limestone from a. to the top of the outcrop.

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stone is exposed 80 rods south of the quarry just mentioned. The fossils in the limestone at Peebles are silicified, and well preserved, but were only found in the residual material of cavities where the chert nodules had weatherd into an earthy mass.

Section of strata exposed one-fourth mile east of Peebles.

Feet
2. Gray dolomite, in layers 4 to 14 inches thick, with very even beds.--20
1. Maquoketa shale.---------------------------------------6

Outcrop of rocks south of Byron.

Two miles north of South Byron, along the line of the C. M. & St. P. Railroad, there is exposed in an old quarry, a thickness of 40 feet of limestone (corresponding to the lower part of the Mayville section, but no Maquoketa shale was observed.

Section of strata exposed at Brillion.

Feet
5. Dolomite, in layers 6 to 15 inches thick, with cavities and fossils in the lower part.-------------------------26
4. Nearly white, marble like dolomite, in layers 2 to 5 feet thick.---10
3. Thin, irregular, dark gray, cherty dolomite.-------------8
2. Very hard dolomite, in even layers 6 to 18 inches thick, varying in color from light pink to very dark red.---10
1. Dolomite in thick layers, containing many cavities.------10

The lower part of number 4 above furnished fossils similar to those of the Mayville section, (Virgiana barrandei var.) In the bottom of the quarry drill holes have penetrated 36 feet of limestone before reaching the Maquoketa shale.

Section of strata exposed at High Cliff. Feet

4. Gray limestone, in layers 10 inches thick.----------------6

3. Dolomitic limestone in very thin, irregular layers, composed very largely of chert.---------------------------2

2. Even layers of gray dolomite, in beds 18 to 36 inches thick, with many cavities.-------------------------------17

1. Limestone penetrated by drill but not exposed.------------12

The Maquoketa shale which lies immediatly below the limestone of number 1 of the above section, reaches a total thickness of 200 feet or more but is not exposed in this locality.

Section of strata exposed at Brick Yard, six miles south of High Cliff.

7. (Mayville limestone): Irregular beds of hard, gray dolomite, in layers 1 to 2 feet thick.-------------------10 Feet

Members 1 to 6 are Maquoketa shale.

6. Grass covered, shale slope.-------------------------------18

5. Grass covered shale slope, but with Maquoketa limestone fragments.-----------------------------------103

4. Grayish-yellow shale with thin layers of limestone.------4

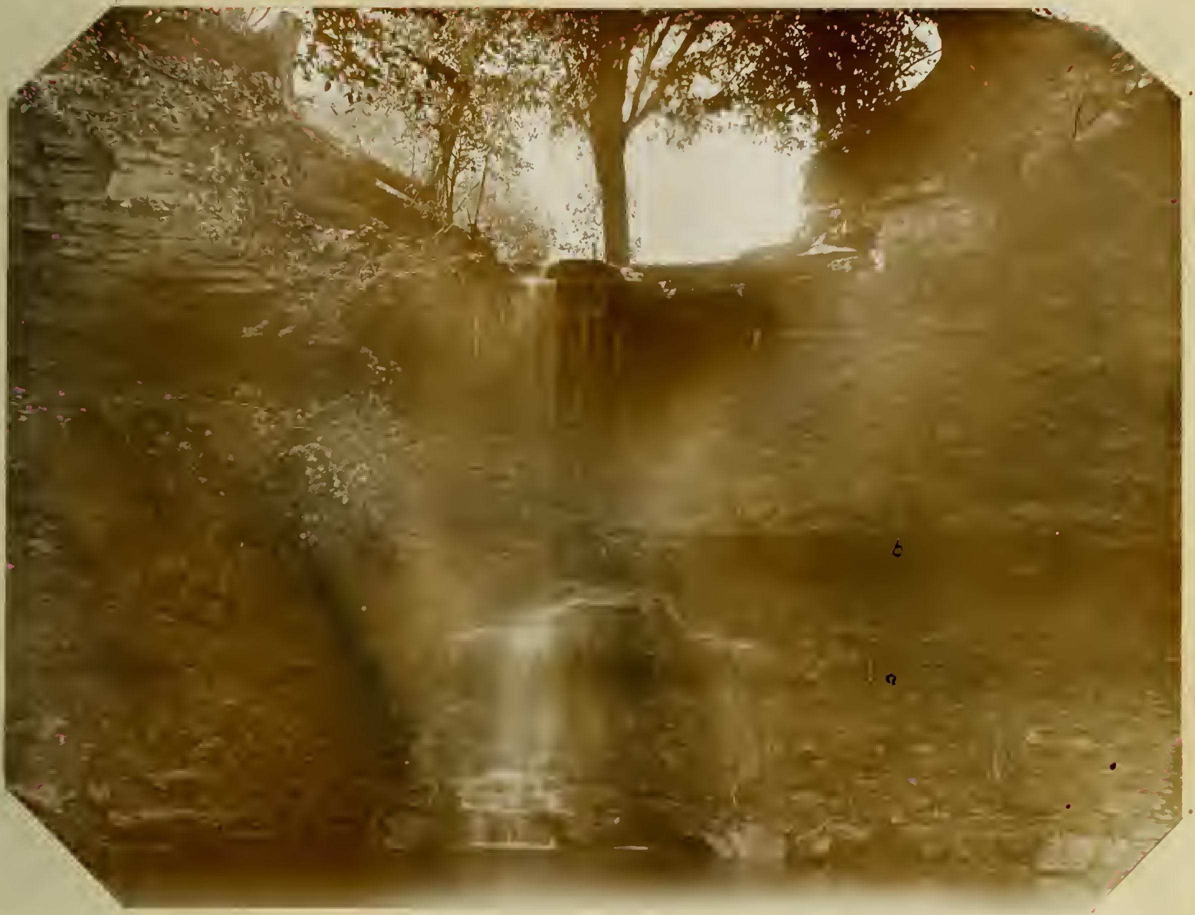
3. Fine grained, dark gray shlae.---------------------------15

2. Dark gray shale, alternating with layers of coarsely crystalline limestone,in layers 2 to 4 inches thick.-----6

1. Fine grained, dark gray shale, down to the level of Lake Winnebago.---------------------------------------35

Section of strata exposed at Greenleaf.

5. Very dark, gray, compact dolomite, in layers 4 to 10 inches thick.---------------------------------------15



Cascade Falls

Maquoketa Shale extending from the Water to the Hammer at (a); Maquoketa Iron Ore from (a) to (b); Mayville Limestone Extending to the top of the Exposure.

4. Dolomitic limestone, in thin, uneven layers, composed largely of chert.---------------------------------2 Feet

3. Dolomitic limestone, in thick uneven layers, with some chert, and many cavities.--------------------13

2. Limestone penetrated by drill, but not exposed.--------8

1. Maquoketa shale.---

Section of strata exposed at Cascade Falls five miles east of De Pere.

6. Coarsely crystalline, vesicular dolomite, in layers 4 to 18 inches thick.-------------------30 Feet Inches

5. Band of fragmental limestone cemented with pyrite.--3

A very distinct unconformity.

4. Evenly bedded, oolitic iron ore.---------------4

3. Dark gray, finely laminated shale.----------------------1

2. Oolitic, iron ore, together with impure, finely granular, shale like iron oxide.---------------1 4

A minor unconformity

1. Hard, indurated , calcareous shale.------------6

Along the west shores of Green Bay, twelve miles west of Sturgeon Bay, there is an outcrop of Maquoketa shale about 80 feet thick, capped with a thin layer of Silurian limestone. The Maquoketa strata in this place are composed of very hard, dark gray, argillaceous limestone,or calcareous shale with no fossils, and marked by sun cracks and numerous ripple marks. In this vicinity Silurian limestone appears at the surface of the ground in many places, but without furnishing good outcrops.

At the township line six miles west of Sturgeon Bay, there is a limestone exposure six feet in height, which shows the same fossil zone found in the quarry south of Mayville, and which contains numerous fossils of Virgiana barrandei var.

Comparison of Outcrops of the Alexandrian Series.

The striking lithology of that part of the Silurian system, long known as the Mayville has been well described by Chamberlin[36] Fossils are so rare in this part of the Silurian section that it is very difficult to correlate horizons in different parts of the state. There is however one fossil zone that is persistant and reliable for purposes of correlation, and which is well represented at the top of the section three miles south of Mayville. This zone is composed of vast numbers of a striated, Pentameroid shell, Virgiana barrandei var., which forms the major portion of strata 20 to 30 feet in thickness. This zone enables definite correlations to be made of the strata at Mayville, Marblehead, Brillion and west of Sturgeon Bay, and is considered by Chamberlin to mark the top of the Mayville formation. The total thickness of the Mayville can thus be easily determined at the different localities. The thickness of this limestone is about 100 feet at Mayville, but it increases towards the north, reaching a maximum thickness at Marblehead where it is 177 feet. In the town of Byron, south of Fon Du Lac , there are many outcrops of a compact gray limestone, which Chamberlin[37] thought belonged to a horizon above the Mayville. We correlated these beds with

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[36] T. C. Chamberlin:-Geol of Wis. vol. II, 1873-1877, p 335

[37] Ibid p.346

similar appearing beds exposed along the shores of Green Bay, and called all of them Byron beds. The fossil horizon above mentioned is found near the top of the section near Marblehead in the town of Byron where it has been well exposed in the extensive quarry operations. This fossil zone proves conclusively that the so-called Byron limestone of the area south of Fon Du Lac corresponds to the upper part of the Mayville, notwithstanding the lithological similarity of the rocks in the region south of Fon Du Lac, and along the shore of Green Bay, and the dissimilarity of the Mayville limestone in the vicinity of Mayville. The Byron limestone of the Green Bay region overlies the Mayville, but the fact that beds that overlie the Mayville have been correlated with beds of limestone thatcan be certainly correlated by means of fossils with the upper part of the Mayville itself, invalidates the name Byron beds.

The strata exposed in the lower part of the two quarries at Marblehead, consist of hard, gray dolomite with narrow, but very perfect bedding planes. The limestone in the middle part of the section south of Mayville is also thin bedded, but the bedding planes are less perfect than in the strata at Marblehead, and there is some chert present in the former section, which is absent at Marblehead. There is thus a well marked difference in the rocks representing the same horizon in the two regions. At Marblehead the strata corresponding to the lower part of the Mayville section is not exposed by quarry operations.

At Brillion the fossil zone is not so well distinguished because of the very imperfect way in which the fossils (Virgiana barrandei var.) have been preserved, but they leave no doubt as to the horizon. The lower ~~part of the~~ part of the section at the

latter locality contains a zone of thin bedded limestone that is remarkable for its very dark red color. The Mayville beds near Mayville, Peebles, Oakfield, and Marblehead show occasional pink markings, but in no other place has this deep red color been observed.

Six miles west of Sturgeon Bay this fossil zone outcrops to a height of six feet, but the limestone has the same appearance as the beds at Mayville and the fossils are well preserved.

Below this fossil bearing zone in the Mayville limestone the formation contains very few fossils, and those that are found are with few exceptions only impressions and casts of such coarse forms as Favosites.The very coarse grained dolomite retains no more than traces of the more delicate forms, and it is only where the shells are silicified that any evidence remains concerning the life of these early Silurian seas. A very few fossils were found near Mayville, and a few coral casts were collected elsewhere, but the only good fauna discovered below the upper fossil zone was at Peebles. At this place the strata just below the soil contain numerous nodules of chert, one to four inches in diameter. Many of the chert masses have entirely disintegrated in the process of weathering, leaving a little residual clay in the cavities of the rock. In this residual clay of the chert nodules were found many beautifully preserved fossils. The age of the lower part of the Mayville limestone of eastern Wisconsin was determined very largely by means of this fauna from Peebles.

Table of Fossils from the Mayville Limestone.

The fossils listed below are from the upper fossil zone of the Mayville limestone.

At Brillion

Favosites favosus
Favosites hispidus
Favosites sp.
Favosites sp.
Favosites sp.
Favosites sp.
Halysites catenulatus
Clorinda sp.
Virgiana barrandei var.

Near Mayville.

Chonophyllum sp.
Streptelasma sp.
Clorinda intermedia
Leptaena rhomboidalis
Orthis flabellites
Virgiana barrandei var.
Trematonotus sp.
Cyclonema daytonensis

At Marblehead.

Virgiana barrandei var.

Near Little Sturgeon Bay

Virgiana barrandei var.

The fossils listed below are from the lower part of the Mayville limestone.

Near Peebles.

Aulopora sp.
Favosites sp.
Favosites sp.
Halysites catenulatus
Lyellia thebesensis
Lyellia sp.
Syringopora sp.
Zaphrentis sp.
Atrypa putilla
Camarotoechia? antiqua
Clorinda thebesensis
Clorinda sp.a.
Clorinda sp.b.
Dalmanella edgewoodensis
Orthis flabellites var. fissiplicata
Orthis sp.
Pentamerus parvulus
Platystrophia daytonensis
Rhynchotreta parva
Homoeospira fiscellostriata

Near Greenleaf

Clathrodictyon sp.

Favosites sp.

Favosites sp.

Halysites catenulatus

At Neda

Favosites sp.

Diphyphyllum caespitosum

Halysites catenulatus

Lyellia thebesensis

Atrypa putilla

Orthis flabellites

CORRELATIONS AND GENERAL CONCLUSIONS:

During Alexandrian time there were three successive invasionsof the sea; each one more extensive than the preceeding one. After each of these invasions there was a period of sea withdrawal , so that the rocks deposited during the successive surbmergances are separated from one another by unconformities. The deposits laid down during the successive invasions are marked by distinct, but closely related faunas. The first and oldest of these invasions was the Girardeau, which reached north as far as southern Illinois. The following Edgewood invasion was more extensive, but extended only to the Mississippi Valley. The invasion during which the Brassfield limestone of Ohio, and the Sexton Creek limestone of the Illinois-Missouri region were deposited was the last, and by far the most extensive.

During this time the sea probably had a broad connection with the Gulf of Mexico region, and formed a large interior basin in the Mississippi Valley, with an embayment in Arkansas and Tennessee on the west, and another on the east of the Cincinnati axis in Ohio. The Brassfield limestone of Ohio contains fossils that occur in the Edgewood of Illinois, and fossils are found in the upper part of the Sexton Creek limestone in Illinois that do not occur in the Brassfield of Ohio. This seems to indicate that the waters entered the Illinois region earlier, and lingered there longer than they did in the basin east of the Cincinnati axis.

Correlations of the Edgewood Limestone-It has been shown that the iron ore[38] of eastern Wisconsin; which was formerly correlated with the Clinton ore of the Applachian region, is in reality of Maquoketa age. The lower part of the Mayville limestone that has long been considered of Niagaran age, is all that it is possible to correlate with the Alexandrian series. The fauna secured from the limestone at Peebles contains such well known Edgewood species as Atrypa putilla, Lyellia thebesensis, Camarotoechia? antiqua, Clorinda thebesensis, Dalmanella edgewoodensis, and Rhynchotreta parva. This fauna definitely correlates the middle part of the Mayville limestone with the Edgewood formation of Illinois and Missouri. At Neda a thickness of about thirty feet of the lower part of the Mayville limestone is in places present above the iron ore, but much of this limestone has been stripped away in mining operations. The fossils Atrypa putilla, and Lyellia thebesensis were collected from this waste limestone in this locality. This indicates that the lower part of the Mayville limestone, as well as the middle part of the Mayville limestone which is presented at Peebles, is of Edgewood age. It seems certain that the greater part of the Mayville limestone is to be correlated with the Edgewood of Illinois, and that no rocks as old as the Girardeau of Illinois occur in eastern Wisconsin.

Conditions for the preservation of fossils in the Mayville limestone were so poor that a far smaller number of species has been found in the Alexandrian of Wisconsin, than in the

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[38] Savage and Ross; Paper soon to be published in Amer. Jour,Sci

corresponding beds of Illinois, but the faunal evidences support the view that the Wisconsin and Illinois-Missouri areas represent separate basins of deposition. The limestones of the Illinois-Missouri region are largely made up of calcium carbonate, while those of Wisconsin are dolomites, hving a very different texture, and appearance, which also indicates different conditions of deposition. A more important fact is that in this section of the early Silurian strata, the Alexandrian rocks grade upwards into those that are clearly of Niagaran age without a depositional hiatus.

The Sexton Creek Limestone-The Brassfield limestone has been very thoroughly studied in the Ohio region by Foerste. The Silurian character of its fossils has been noted, but it was at first correlated with the New York Clinton. The work of Schuchert[39] on the strata of the Anticosti section made it evident that the Brassfield limestone was older than the New York Clinton, and its true relationships were with the older portion of the Anticosti sections.

The comparative table of fossils from the Ohio, Kentucky, and Illinois-Missouri regions has already been given. The total number of fossils identified from the three regions is 220. Of this number 165 have been listed from Ohio, 99 from Illinois, and 30 from Kentucky; 42 are common to both Illinois and Ohio; 19 are common to both Illinois and Kentucky; and 16 are common to all three regions. The large number of common fossils is good evidence

[39] 39:Schuchert, Bull. Geol. Soc. Am. vol. 20, 1909, pp. 427-606

of the close relationship of the two formations, but the character of the common fossils is more conclusive. The Brassfield limestones contain a number of excellent guide fossils which differentiate them from all other formations. The better fossils of this class are Pentamerella? manniensis, Rhinopora verrucosa, Triplecia ortoni, Stricklandenia triplesiana, and Strophonella filistriata.

It is probable that during the deposition of these limestones there was a wide sea connection southward with the Gulf of Mexico region, and that the waters entered the Sexton Creek basin earlier than they did the Brassfield basin, and that they lingered longer in the latter basin.

Considerable work has been done on the Anticosti section by Schuchert and T~~o~~wenhofel[40], and upon the Medina and Cataract formations by Schuchert[41], which enables us to make correlations between these different formations. In his report on the Medina and Cataract formations, Schuchert says concerning the relation of these formations to the Brassfield, "The Cataract may also be compared with the Brassfield of Ohio and Indiana, as the two are closely related, and as both are also of limestone facies. The former has 76 species, the latter 140. Between them there are 42 forms in common, and of these the following have the most significance in correlation: Clathrodictyon vesiculosum, Acervularia gracilis (In Ohio A. clintonensis), Rhinopora verrucosa,

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40 T~~o~~wenhofel: Mus. Bul. Canada Dept Mines No. 3

41 Schuchert: Bull. Geol Soc. Am. vol. 25, 1914, pp. 277-320

Phaenopora ensiformis, Callopora magnopora, Homotrypa confluens, and Hebertella fausta. When the two biotas are finally carefully compared with each other, there will undoubtedly be added more significant forms, strengthing the view that the Brassfield and Cataract are fairly close correlates in time. However these two faunas are not of the same epicontinental basin, one can not expect a large percentage of the forms to be common to both; the Brassfield element came in from the Gulf of Mexico region, while the Cataract migrated in from Ontario through the Gulf of St. Lawrence embayment across the province of Quebec, or came in from the Arctic".

* * * *

"That the Cataract is also a close correlate with the Medina has been shown, and that it is equally so with the Brassfield can be brought out in still another way. The Cataract has 76 forms, and of these 22 have no stratigraphic significance, of these 54 species, 24 also occur in the Brassfield, 7 in the Medina, 10 are restricted, while 30 pass upward into the Clinton or higher formations".

* * * *

"Relation to the Silurian of Anticosti-The Cataract does not readily correlate with the Anticosti section because of the marked differences and generalized character of the faunas there, and more especially because of the long range of most of the species. With the Bescie River, the only guide fossil in common is Coelospira planoconvexa (appearing about about 70 feet above the base of the Bescie River): but the Anticosti individuals are only half grown compared with those of the Cataract, a condition seemingly in harmony with the conclusion that the latter are of

a younger time. Then the absence in the Cataract of the Bescie River guide Clorinda barrandei[42], also seems to indicate that the former formation is of a younger age. At the top of the Bescie River however, the fauna is more like that of the Cataract, and this similarity continues in the succeeding 300 feet of the Gun River formation".

"On the other hand the Brassfield correlates more readily with the Anticosti section and apparently best with zone D8 of the Gun River, which is from 240 to 300 feet above the Bescie River. It is here that Triplecia insularis (compares with T. ortoni of Ohio), and Stricklandinia lens(compares with S. triplesiana of Ohio), appears for the first time. That the correlation can not be made with the next higher zone D9, is attested by the presence here of Atrypa reticularis, Pentamerus oblongus, and Coelospira hemispherica, species that in New York and Ontario are not seen below the Clinton. For these reasons, then, it may be said that the Brassfield, Cataract, and Medina seem to hold the horizon of the lower part of the Gun River formation or, more exactly,from D6 to D8, a thickness of178 feet".

The fauna of the upper part of the Mayville limestone of eastern Wisconsin is very limited with regard to numbers, but at least one species seems to aid much in clearing up the relationships of these formations. The fossil that occurs in such great numbers near the top of the sections south of Mayville, and in a number

[42] Virgiana barrandei of Twenhofel.

of other widely separated localities, is almost identical with the guide fossil of the Gun River mentioned under the name of Clorinda barrandei by Schuchert[43]. This is the same form listed under the name Virgiana barrandei by T~~o~~wenhofel[44]. The Anticosti specimen has only a slightly more distinct sinus, and the similarity of the two forms may be seen in the accomp~~ia~~anying plate.

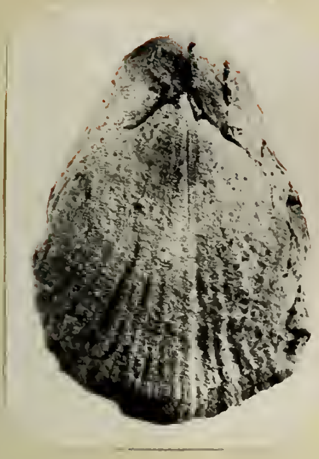
Schuchert pointed out the correlation that can be made between the zone D8 of the Gun River formation and the Brassfield limestone. As the fossils that he mentioned occur near the top of the Brassfield limestone we have the top of the Brassfield very closely correlated with this zone D8 of the Gun River formation. The Bescie River guide fossil Virgiana barrandei we now know occurs in eastern Wisconsin as Virgiana barrandei var.. This makes possible an even closer correlation between this zone and the one last mentioned, and ties up the two sections in a very definite manner.

Schuchert says that he has not found Clorinda barrandei in either the Cataract or Medina formations[45], but neither has it been found in the Brassfield limestone of Ohio, or the Sexton Creek limestone of the Illinois-Missouri region. It seems much more probable that this form came into the Wisconsin region by the direct route from the northeast, than by way of the Gulf of

[43] Schuchert: Bull. Geol Soc. Am. vol 25, 1914, p. 292

[44] T~~o~~wenhofel: Mus. Bull. Canada Dept. Mines No. 3 p. 27

[45] Schuchert: Bull Geol. Soc. Am. vol. 25, 1914 p. 292



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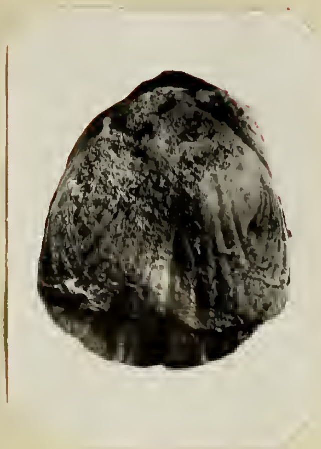

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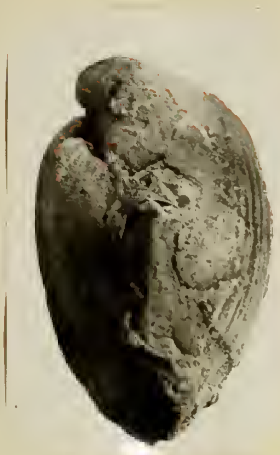

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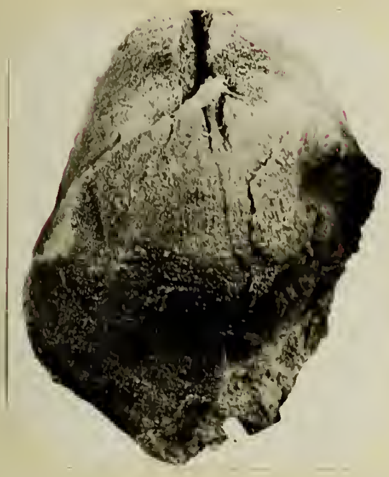

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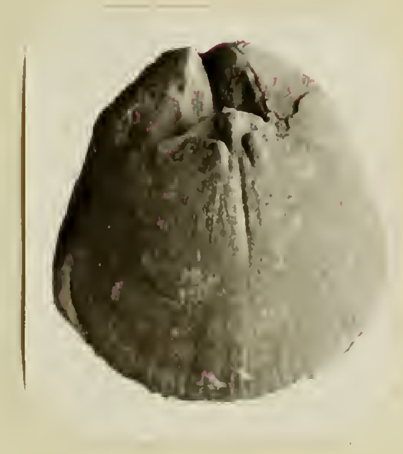

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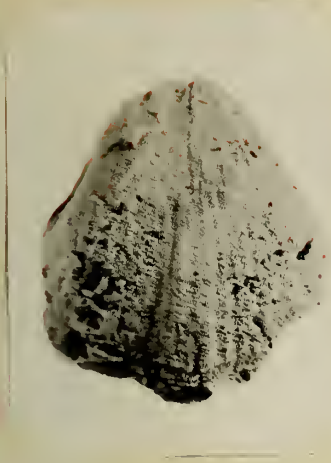
Views of Virgiana barrandei var. Mayvillensis Savage

Numbers 1 and 2 are dorsal views of specimens from Mayville: number side view of specimen from the same locality: numbers dorsal views of specimens from Marblehead.



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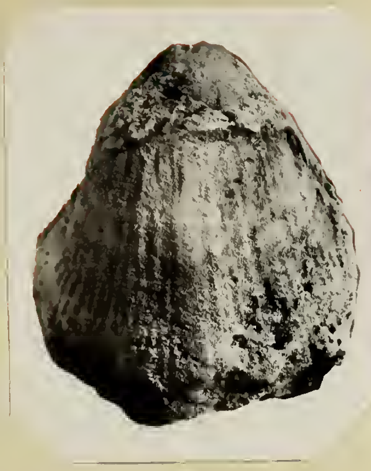

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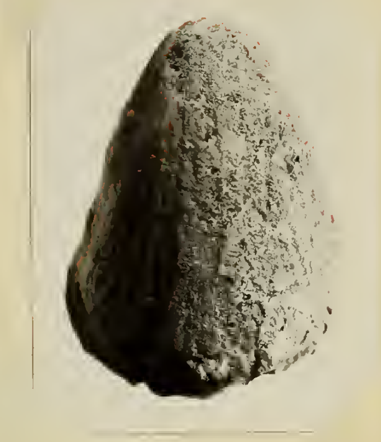

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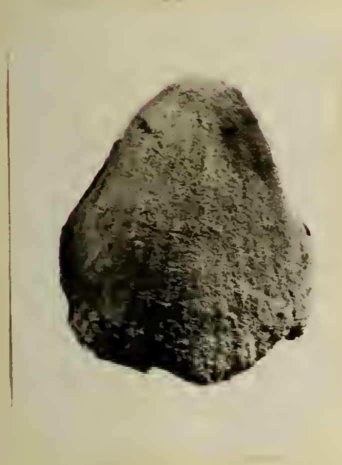

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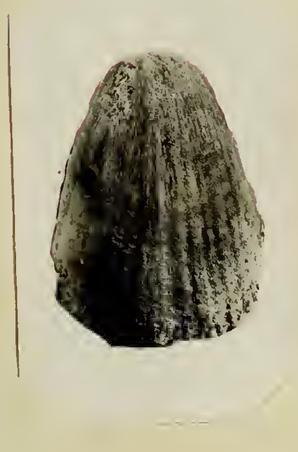

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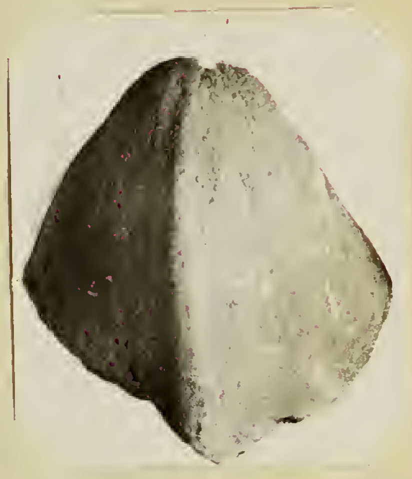


6

Views of The Ventral Valve of Virgiana barrandei var. Major Savage

Numbers 1, 2, 3, 4, and 5 are from the quarry three miles south of Mayville, Wisconsin, and number 6 is from the second quarry at Marblehead, Wisconsin. Numbers 1, and 2 are marked by a strong median fold, numbers 3, and 5 are elongate, with less distinct fold, and number 4 is without fold, and with a broad flattened ventral valve.

Mexico, from which region it could hardly reached Wisconsin without leaving any reccord in the Brassfield of Sexton Creek limestones. It seems safe to assumethat this fauna of upper part of the Mayville limestone represents a northeastern migration.

The Brassfield species Pentamerella? manniensis (Foerste) has very much in common with Virgiana barrandei of the Anticosti, and Mayville regions. The shape and markings of the dorsal valve in the two species are almost identical, and when the two are compared they are almost indistinguishable. In both there are the same radiating striations, and obscure sinus upon a slightly arching valve. The ventral valves are similarly striated, but in V. barrandei this valve is decidedly elongate and galeatiform, while in P?. manniensis it is much less arched. In V. barrandei there is a tendency for a strong median fold to form in old specimens, but this is not always the case and some specimens closely approch P?. manniensis in shape. The accompnying plate will show the resemblance of the Anticosti and Mayville forms of Virgiana barrandei to Pentamerella? manniensis from theSexton Creek limestone.The two species have so many similarities that there can be no doubt that they represent the same genus, and that the so-called Pentamerella? manniensis developed out of a form resembling Virgiana barrandei. If this is the case Virgiana barrandei ~~is the~~ is the northern representative, and Pentamerella? manniensis is the southern representative of this type, both occupying the same horizon in the Alexandrian series. For these reasons there seems to be no doubt that Pentamerella? manniensis belongs to the genus Virgiana, and the name Virgiana manniensis is proposed for it.

Pentamerella? manniensis marks the lowest part of the Sexton Creek limestone in Illinois, and while the absence of any unconformity in the Wisconsin area makes correlation more difficult, Virgiana barrandei var. seems to occupy a nearly corresponding position in that region. This correlates the basal portion of the Sexton Creek limestone with the upper part of the Bescie River formation of the Anticosti section. This would make the Brassfield and Sexton Creek limestones correspond to the upper portion of the Bescie River formation and the lower 300 feet of the Gun River formation, up to zone D8.

The marked difference between the Alexandrian strata in the Wisconsin and Illinois-Missouri areas indicates that there were two distinct basins of deposition; the one with a sea connection eastward to the Atlantic, probably by way of the Gulf of St, Lawrence, and the other connected southward with the Gulf of Mexico region. A low land barrier in the vicinity of the Illinois-Wisconsin state line probably separated these basins, The distance between the most southern outcrop of the Mayville and the most northern exposure of the Sexton Creek starta is about 80 miles, and yet in that distance there is an entire change in lithology, and the faunas exhibit very different characteristics. There must have been a broad connection between the two basins when the typically southern fauna of the Edgewwod limestone entered the Wisconsin region in early Alexandrian time. Between Edgewood and Sexton Creek time there was probably a partial withdrawal of the waters in the Mississippi Valley, but no such withdrawal seems to have occured in the Wisconsin basin at this time.

SUMMARY

The work of Dr. Savage has shown that the Girardeau limestone is present in a rather limited area in the vicinity of Thebes, Illinois and Cape Girardeau, Missouri. This is the oldest formation of the Alexandrian series in the Mississippi Valley. Its fauna is typically southern and entered this basin of deposition from the Gulf of Mexico region. No strata of Girardeau age have been found in southern Wisconsin.

The Edgewood limestone has a much wider distribution than the Girardeau, and is found in a number of widely separated regions, in southern, western, and northeastern Illinois, and southeastern Wisconsin; and strata of similar age occur in northwestern Illinois and eastern Iowa. The Edgewood fauna like that of the Girardeau is of southern origin, and entered the region from the Gulf of Mexico.

The Sexton Creek limestone is more extensive than the Edgewood, but has much the same general distribution. It occurs in southern, western, and northeastern Illinois, eastern Missouri; and strata of similar age occur in eastern Iowa, and eastern Wisconsin. In all of these localities these limestones have formerly been considered a local phase of the Niagaran.

An important part of the magnesian limestones of eastern Wisconsin, are in reality of Alexandrian age. There is no evidence

of an unconformity separating the Alexandrian from the Niagaran in this region, and the upper limits of the former series can not at present be definitely located. The total thickness of the Alexandrian series of eastern Wisconsin is hardly less than 200 feet and may be as much as 300 feet, constituting at least one-third of the beds formerly called Niagaran.

The greater part of the Mayville limestone of Wisconsin corresponds to the Edgewood formation of the Illinois-Missouri region, and the fauna though less extensive than that of the Edgewood in the latter region is practically identical with it.

The upper part of the Mayville limestone corresponds in age to the Sexton Creek limestone. The contact between this formation and the Niagaran in Wisconsin lies between the top of the Mayville limestone and the base of the Racine beds.

The fauna of the Edgewood formation of Wisconsin like that of Illinois has a southern aspect, denoting connections of this basin with the Gulf of Mexico during the time of its deposition.

The fauna of the Sexton Creek limestone is in many respects very similar to that of Anticosti Island, strongly indicating a northeastern sea connection during this time. The deposition in eastern Wisconsin was continuous throughout Alexandrian, and Niagaran time. The basin of deposition had first a southern and later a northeastern sea connection, with an opportunity for the mingling of the faunas from these different sources.

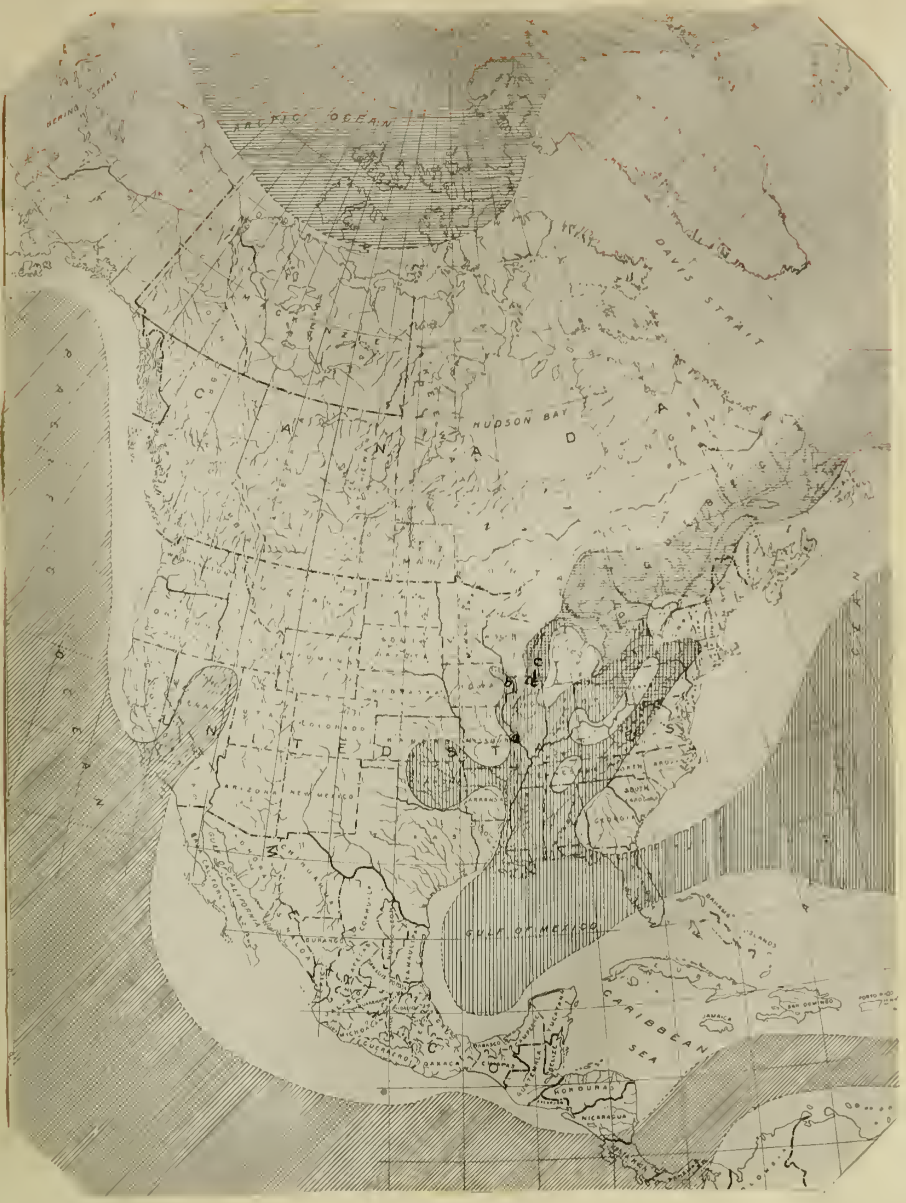
The Girardeau and Edgewood formations correspond to some part of the lower portion of Silurian of the Anticosti section

but exact correlation is impossible because of the southern character of the faunas of the former formations, and the local character of the latter.

In eastern Wisconsin the fossil zone of Sexton Creek age can be definitely correlated with a zone about 70 feet above the base of the Bescie River formation of the Anticost section, as indicated by the presence of Virgiana barrandei in the Bescie River formation, and of Virgiana barrandei var. in eastern Wisconsin.

Virgiana (Pentamerella?) manniensis is a southern representitive of the same genus to which Virgiana barrandei belongs, and therefore Virgiana (Pentamerella?) manniensis which is found in a persistant zone near the base of the Sexton Creek formation in the Illinois-Missouri region can also be correlated with the Virgiana barrandei zone about 70 feet above the base of of the Bescie River formation of the Anticosti section.

The upper limit of the Sexton Creek limestone of Illinois which is marked by such fossils as Triplecia ortoni, and Rhinopora verrucosa, corresponds with zone D8 of the Gun River formation of the Anticost section.



Seas of Alexandrian Time.

The Illinois-Missouri area indicated by (a); the Iowa area by (b); the Wisconsin area by (c); the temporary connection of the Illinois- Missouri area with the Wisconsin area by (d).

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